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MARCH, 1957

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THE BRYOLOGIST

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BRYUM RAMOSUM AND SOME OF ITS ALLIES IN PAN-PACIFIC AND INDO-MALAYAN AREAS

HARUMI OCHI[1]

Bryum ramosum and its allies are generally distributed in tropical and subtropical areas, but some are known from the warm-temperate areas of the world, as well. Since these species were established, however, most of them remain to be re-examined critically and compared with one another. I have been able to examine 102 specimens of the following species mostly from Pan-Pacific or Indo-Malayan areas: *Bryum decaisnei* Dozy & Molk., *B. goudotii* Hampe, *B. greenwoodii* Dix., *B. ramosum* (Hook.) Mitt. and *B. wichurae* Broth. It is granted that 102 is by no means a large number of specimens on which to base a revision of this group, especially since only 44 packets were collected in countries other than Japan. To my great good fortune and happiness, however, I was able to see the types of both *B. decaisnei* and *B. wichurae* and also material of *B. ramosum* collected by its author, J. D. Hooker, in Sikkim-Himalaya and of *B. decaisnei* var. *subramosum* Fl. collected by M. Fleischer in Java, ten packets named *B. greenwoodii* collected on Viti Levu in the Fiji Islands and 58 packets of *B. wichurae* from Japan. In view of the fact that these species are by no means common and that I was able to see a number of typical or important specimens, or fairly numerous collections from small areas, such as Viti Levu and Japan, I have dared to propose here some definite opinions.

I wish to express gratitude to Mr. E. B. Bartram, Dr. H. Persson and Dr. H. A. Crum for their kind assistance in making available specimens and literature and in making useful suggestions. Sincere thanks are also due to Prof. Y. Horikawa of Hiroshima University for his guidance and help in

[1] Biological Institute, Faculty of Liberal Arts, Tottori University, 1, Tachikawa-cho, Tottori City, Japan

supplying material and literature, and to Prof. A. Noguchi and many other bryologists and friends in Japan who have helped in various ways: Prof. S. Kitamura, Dr. M. Tagawa, Dr. S. Hattori, Mrs. U. Mizushima, Messrs. K. Mayebara, T. Nakajima, H. Suzuki, K. Oti, T. Shin, H. Ando, I. Nagano, Z. Iwatsuki, T. Osada and S. Nakanishi.

Observations and Discussion

The Sporophyte. Generally speaking, these species, and particularly *B. greenwoodii*, *B. goudotii* and *B. wichurae*, rarely fruit. None of the specimens which I saw was in good fruit though a few had sporophytes. Therefore I hesitate to give any definite opinions on sporophytes here. Fleischer, in his *Musci der Flora von Buitenzorg*, distinguished *B. decaisnei* and *B. zollingeri* from *B. ramosum* by the relative lengths of the outer and inner peristomes, but he said that he had only sterile specimens of *B. zollingeri* from Java and had examined only five packets of *B. ramosum*. Therefore, we must be very critical of his opinion of these species. Some variation in the relative lengths of outer and inner peristomes can be seen in the other species of the group, and also the peristome length often appears different from its actual length under the microscope depending on the technique in making preparations. For these reasons, the slight difference between inner and outer peristome lengths is perhaps of little importance, although I have been unable to look over all the specimens cited by Fleischer.

The Gametophyte. As described by many authors, these species occur on soil, humus, bark of trees, rocks, etc. and not on any definite substratum. To judge from stations in Japan alone, they occur on various substrata in southern districts but in the high altitudinal stations or in the north often on rocks, especially limestone. This sort of habitat preference is not peculiar to these species alone but seems rather common in some of the species belonging to tropical or subtropical elements in Japan. The gregariousness of stems or the compactness of the moss cushion is also fairly variable, according to habitat, as are robustness, degree of branching and length of stems, arrangement and angle of leaves and their appearance when dry. On the whole, these characters are perhaps of little importance.

The leaves are very variable in shape (*fig.* 1). The ratio of length to width varies from 1.8:1 (var. *latifolium*) to 4:1 (var. *longifolium*). Similar features were noted by Fleischer in Javanese material of *B. decaisnei*. Many kinds of leaf shape, such as ovate, obovate, broadly obovate, oval, ligulate, narrowly ligulate, oblong, oblong-lanceolate and lanceolate occur. Leaf apices may be obtuse to acute or sometimes acuminate. Leaves with acuminate points

are often concave, especially toward the apices; the concavity shows as a fold in the tips when the leaves are observed under a microscope (*fig.* I). The costa varies from ceasing below the apex to long-excurrent forming an arista (*fig.* I), and its stoutness also varies.

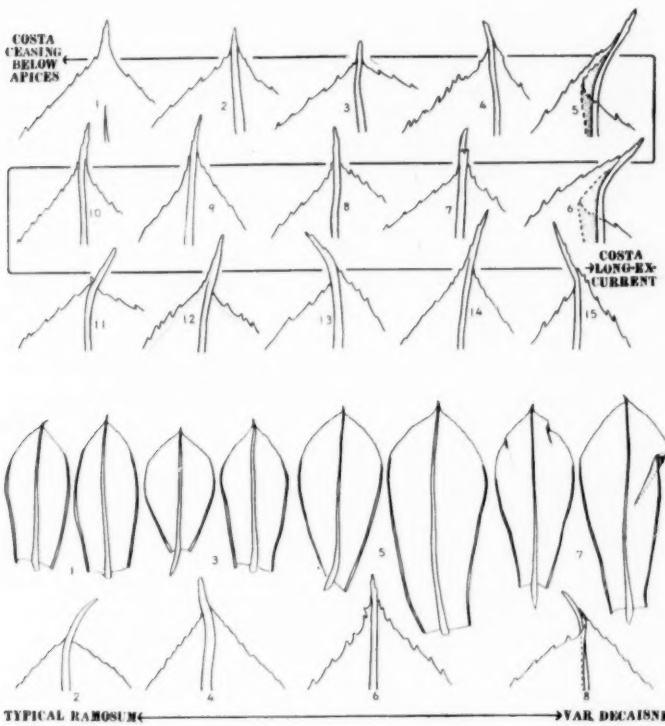

FIG. I (above). Leaf tips of *Bryum ramosum* and its var. *decaisnei*. 1. Japan (in herb. Ochi, no. 2539). 2. Japan (in herb. Ochi, no. 2578). 3. Japan (in herb. Ochi, no. 4119). 4. Japan (in herb. Ochi, no. 5045). 5. Himalaya (type of *B. decaisnei*). 6. Japan (type of *B. wichurae*). 7. Japan (in herb. Ochi, no. 5808). 8. S. China. 9. E. Java (Fleischer's exs. no. 309). 10. Japan (in herb. Ochi, no. 5586). 11. Philippine Is. 12. Himalaya (J. D. Hooker *leg.*). 13. Formosa. 14. Japan (in herb. Ochi, no. 2851). 15. Burma. (All figures ca. × 30.) FIG. II (below). Leaves (× 6) and leaf tips (× 30) of specimens named *Bryum greenwoodii*, collected from Viti Levu, Fiji Is., all from Bartram's herbarium. 1-2. From no. 118. 3-4. From no. 1101. 5-6. From no. 4191. 7-8. From no. 1097.

The margins vary widely from minutely serrate to longly and sharply dentate. Fleischer described *B. zollingeri* as very sharply long-dentate in the upper margins of the leaves. This character may have some significance, but I have seen neither his material nor typical specimens of *B. zollingeri*, although I have three proofs which were collected in Java and India and named by Brotherus; two of them closely agree with Fleischer's description. I hesitate, accordingly, to state any positive opinion on *B. zollingeri*, but in the case of the five species under discussion in this paper, this character seems to have little importance. The leaf border varies from two to four or more cells in width. This variation can be detected even in material collected at the same station and sometimes even in leaves from a single gametophyte. For these reasons the development of the border seems to be of little significance.

In conclusion, I propose that all five species listed at the beginning of this paper be included under *B. ramosum*, but it is believed that differences in habitat have given rise to three varieties.

After a species has arisen, variations develop during the process of distribution, and finally some of the variations become fixed. Generally, the wider the species is distributed the more remarkable the variations are. As to the characteristics in *B. ramosum*, the following variations can be noted: costae long-excurrent or ceasing below the apex, leaves very broad or very narrow, margins longly and sharply dentate or minutely serrate and strongly reflexed or plane, etc. For the classification of the five species being discussed here, however, it is convenient to consider only two characters, the width of leaves and the development of the costa, although other characters may have to be considered if the relationship with other species, such as *B. zollingeri*, is under consideration. Considering only two characters, I propose four possible varieties as representing the variable extremes. The variations of this, or any other variable species, can be represented graphically as a sphere, which includes all the varieties, forms and individuals, with the variable extremes situated on the surface of the sphere (*fig.* III). As established in the *International Rules of Botanical Nomenclature*, however, the nomenclatural type specimen by no means corresponds to the "typical" or most normal expression of a group. To judge from descriptions and specimens, the nomenclatural type of *B. ramosum* seems to be very close to theoretical variety 1 (*fig.* III), and therefore we cannot propose here a new epithet based on this theoretical variety. As shown in figure II, specimens named *B. greenwoodii* present considerable variation in both leaf shape and costa; some are close to typical *B. ramosum*, and others are close

to var. *decaisnei*. Therefore I have treated them in two groups. To judge from the description, the type of *B. greenwoodii* seems closer to var. *decaisnei* than to typical *B. ramosum*, but, not having studied the type, I cannot give a definite opinion on the subject. There is no doubt, however, that *B. greenwoodii* is at least conspecific with the *B. ramosum* complex, and I have reduced it to synonymy. *B. decaisnei* var. *subramosum* is rather close to typical *ramosum* and not to var. *decaisnei*.

The type of *B. decaisnei* is rather close to the theoretical variety 2 (*fig.* III), in spite of the fact that the costa is longer, and there-

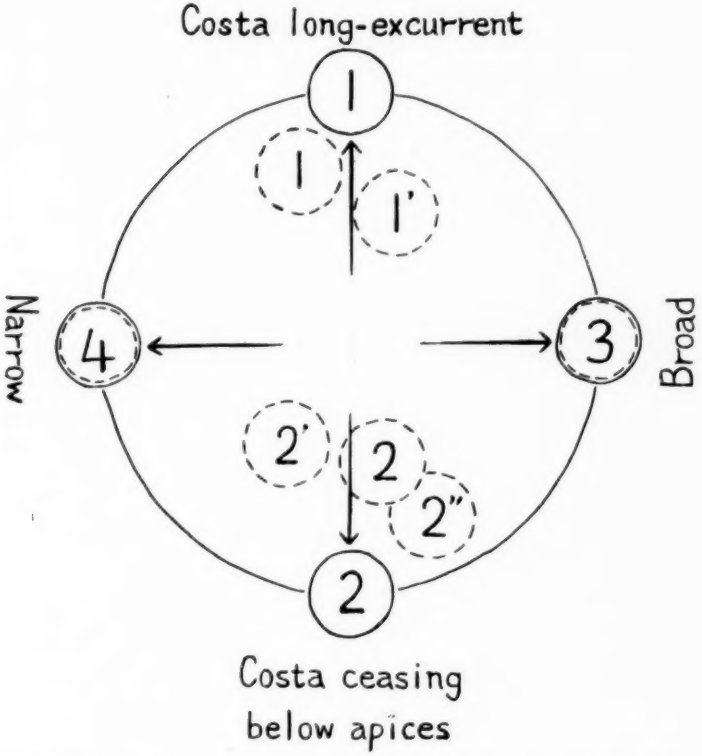

FIG. III. Diagram showing the differentiation of four theoretical varieties of *Bryum ramosum* and the possible situations of (1) typical *B. ramosum* (1') *B. decaisnei* var. *subramosum*, (2) *B. decaisnei*, (2') *B. wichurae*, (2") *B. goudotii*, (3) var. *latifolium*, (4) var. *longifolium* in a sphere representing the theoretical range of variation of the species.

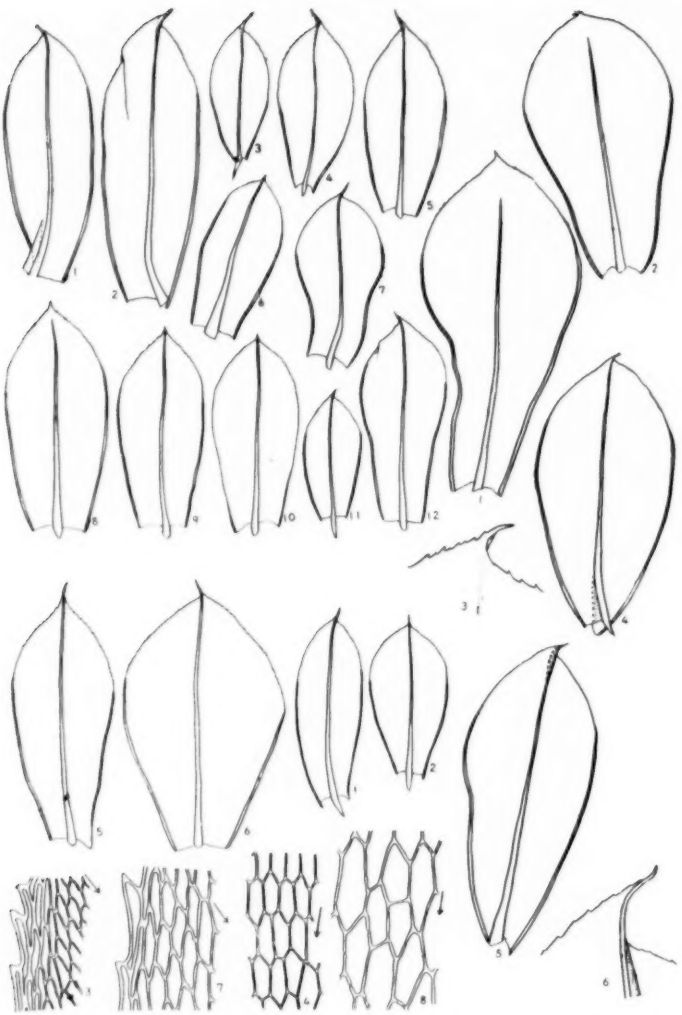

FIG. IV (*upper left*). Leaves of *Bryum ramosum* var. *decaisnei*. 1-2. Japan (type of *B. wichurae*). 3-5. Himalaya (type of *B. decaisnei*). 6-7. Hawaii. 8. Japan (in herb. Ochi, no. 2539). 9. Japan (in herb. Ochi, no. 3618). 10. Japan (in herb. Ochi, no. 2578). 11. Java. 12. China. (All figures × 6.) FIG. V. (*right*). Leaves (× 6) and leaf tips (× 30) of specimens named *Bryum goudotii* collected in Colombia. 1-3. *Schultes & Bell* 11480. 4-6. *Schultes* 11609. FIG. VI (*lower left*). *Bryum ramosum* (1-4)

fore this theoretical variety should be referred to as the var. *decaisnei*. The type of *B. wichurae* is very close to the type of *B. decaisnei* except that the leaves are larger and longer; it should be included under the same variety. Specimens named *B. goudotii* from Colombia (South America) and kept at the National Museum of Canada are also very close to the type of *B. decaisnei* except for their more robust stems and larger leaves; they should also be referred to this variety. *B. ramosum* var. *nymanii* Fl. seems to belong also to the var. *decaisnei*, but I cannot safely venture an opinion as I have not seen any specimens.

As to theoretical variety 3, no such entity has been described previously. I propose here a new variety based on a Burmese specimen in Bartram's herbarium.

Bryum decaisnei var. *longifolium* seems to agree with the theoretical variety 4 (although I have not studied the type) and is transferred as a variety of *B. ramosum*.

Systematics

Bryum ramosum (Hook.) Mitt., Jour. Linn. Soc. Suppl. 1: 75. 1859; Fleischer, Musci Fl. Buit. 2: 566. 1902-04; Bartram, Philipp. Jour. Sci. 68: 142. 1939; Noguchi & Hattori, Musci Jap. Exs. Ser. 6, No. 260. 1952. *Mnium ramosum* Hook., Lond. Jour. Bot 2: 11. 1840. *Bryum decaisnei* var. *subramosum* Fl., Musci Fl. Buit. 2: 563. 1902-04. *Bryum greenwoodii* Dix., Proc. Linn. Soc. N. S. Wales 6: 280. 1930.

Specimens examined: Java: Am Gedeh bei Kandang-Badak, an Andesitfelsen, 2600 m. (*Fleischer*, M. Archip. Ind. ser. 6, No. 288—Exs. of *B. decaisnei* var. *subramosum*, as *B. ramosum* in herb. Bartram). Res. Priangan, G. Gede, in silv. primig. in decl. orient supra Tjibodas, 1420-1650 m. (*Verdoorn*, Archeg. Maleisiacae in It. A 1930 susc. Col., in herb. Bartram). Am Ardjoeno bei Lalidjiwa auf Waldboden, 2100-2600 m. (*Fleischer*, M. Fond. Archip. Ind. ser. 7, No. 309, in herb. Bartram and Stockholm). Prov. Batavia, in Monte Megamendong, in silva Primaeva, apud lecum "Telaga Warna" ad Arbores, 1400 m. (*Schiffner*, Iter. Ind. 11607, in Hattori Bot. Lab. as *B. decaisnei*). Goen Ardjoeno, västsidan i regnskog, 2-3000 m. (*Skottberg*, in herb. Stockholm).

India: Indes Anglaises, Kodaikaual (*Forcau*, Herb. Charrier, in herb. Bartram). Ditto, biger thola, Gulung hills (ditto, in herb. Bartram). Dry clay banks near Verajpet, Coorg. (*T. L. Walker*, in herb. Bartram). Mussoorie, 4-7000 ft., soil (*R. S. Chopra & B. K. Abrol* 448, in herb Nat. Mus Canada). Sikkim-Himalaya (*Hooker*, in herb. Stockholm).

Burma: Loimme, Keutung State, epiphytic, 6500 ft. (*Dickason*, Farlow Herb., Harvard Univ., Bryophytes of Burma 9714.1, in herb. Bartram).

and var. *latifolium* (5-8). 1, 2, 5, 8. Leaves × 6. 3, 7. Apical margins of leaves, × 125. 4, 8. Cells from middle of leaves, × 125.

CHINA: Shaowa & vicinity, Fukien Prov., cracks in tile roof (*Fan Hsioh Niao*, Farlow Herb., Harvard Univ., no. 9212a, in herb. Bartram).

PHILIPPINES: Luzon, clay slope, Mt. Sto. Thomas, Mountain Prov., 7000 ft. (*F. C. Hadden*, in herb. Bartram). Dist. of Lepants (*E. Bacani*, Herb. Bureau of Sci. 17043, in herb. Bartram). Baguio, Mountain Prov., on bank (*H. H. Bartlett* 13358, distributed by the Univ. of Philipp., in herb. Bartram).

FORMOSA: Prov. Shinchiku, Mt. Yura (*Y. Shimada*, ex herb. Noguchi, in herb. Ochi, no. 5947). Prov. Tainan, Mt. Kodama (*Noguchi* 6412, in herb. Hiroshima Univ., no. 875).

JAPAN—INS. YAKUSHIMA: Miyanoura, ca. 1700-1935 m. (*Horikawa*, in herb. Hiroshima Univ., no. 4624, + *Pohlia elongata* Hedw.). KYUSHU: Prov. Osumi, Mt. Kirishima, ca. 1000-1400 m. (*Shin*, 5430, in herb. Ochi, no. 4943). Prov. Hyuga, Minami-naka-gun, ca. 600 m., on bark of tree (*Iwatsuki & Kanno*, in herb. Ochi, no. 5805). Prov. Higo, Kuma-gun, on limestone, ca. 200-400 m. (*Mayebara*, 773, 1145, 2081, 2355, 3333, in herb. Ochi 3604, 3660, 3812, 5067, 5087, also Musci Jap. Exs. Ser. 6, No. 260). Mt. Ohira, ca. 900 m., on bark of tree (*Mayebara*, 1797, in herb Ochi, no. 3688). Mt. Naidaijin, ca. 200-400 m. (*Toyama*, 1538, in herb. Kyoto Univ., as *B. wichurae*). Prov. Chikuzen (*Sugino*, in herb. Ando, no. 17769; in herb. Ochi, no. 6138). Prov. Buzen, Kobura, ca. 400 m., on limestone (*Osada* 855, in herb. Ochi, no. 6114). Ins. Tsushima, Mt. Ariake, ca. 500 m., on soil (*Osada*, 4033, in herb. Ochi, no. 6109). SHIKOKU: Prov. Tosa, Takaoka-gun, Kure-machi (*Horikawa*, in herb. Hiroshima Univ., no 8945). Prov. Iyo, Saijo (*Oti*, 5813, in herb. Ochi, no 2602). Nii-gun, on rock, ca. 600 m. (*H. Ochi*, 4778, 4779). HONSHU: Prov. Bingo, Hjba-gun (*Horikawa*, in herb. Hiroshima Univ., no. 6319). Prov. Bitchu, Atetsu-gun (*Igi*, 293, in herb Ochi, no. 2851). Prov. Yamashiro, Kibune (*Toyama* 632 & *s.n.*, in herb. Kyoto Univ.). Prov. Musashi, Chichibu-gun, ca. 300-600 m., on soil (*Nagano* 3239, 3349, in herb. Ochi, no. 5586, 5647). Nishi-tama-gun (*Mizushima* 8272, in herb. Ochi, no. 5919).

FIJI—VITI LEVU: On humus or decayed wood, ca. 550-1195 m. (*A. C. Smith* 4191, 4462, 5275, in herb. Bartram); on humus or rocks, ca. 2700-3900 ft. (*Greenwood* 1101, 1114, 1118, in herb. Bartram).

AUSTRALIA—SOUTH AUSTRALIA: Mts. Softy Range, Chain of Pond (*D. L. Opfel* 84, in herb. Bartram, as *Bryum capillare*).

CANADA: Vancouver Is., Beaver Lake, on rocks (*J. Macoun* 21, in herb. Nat. Mus. Canada). NEW TO NORTH AMERICA.

Var. **decaisnei** (Dozy & Molk.) stat. nov. *Bryum decaisnei* Dozy & Molk., Musci Frond. ined. Archip. Ind. 19. 1884; Fleischer, Musci Fl. Buit. 2: 560. 1902-04; Brotherus, B. P. Bishop Mus. Bull. 40: 16. 1927; Bartram, B. P. Bishop Mus. Bull. 101: 122. 1933. ? *Bryum goudotii* Hampe, Ann. Sci. Nat. Bot. 5, 4:340. 1866. *Bryum wichurae* Broth., Hedwigia 38: 218. 1899; Horikawa, Hikobia 1: 66, 91. 1951; Ochi, Jour. Jap. Bot. 28: 342. 1953 & Liberal Arts Jour. Tottori Univ.—Nat. Sci. 4: 13. 1953; Noguchi & Hattori, Musci Jap. Exs. Ser. 10, No. 457. 1956.

SPECIMENS EXAMINED: JAVA: Tjibodas in Berggarten an Bäumen u. auf Grasflächen, 1460 m. (*Fleischer*, M. Archip. Ind. ser. 3, No. 146, as *B.*

ramosum, in herb. Bartram). April 1850. Communicat ex herb. Lugduno-Batavo, ex Herb. Dr. Molkenboer (type, in herb. Stockholm). Details unknown, ex herb. Sande Lacoste (in herb. Stockholm).

CHINA: Wang Shau, Anhwei Prov. (*A. U. Stewart* 7192, in herb. Bartram).

JAPAN—KYUSHU: Prov. Satsuma, Higashi-ichiki-machi (*Shin* 7113, in herb. Ochi, no. 4944). Prov. Osumi, Mt. Kirishima, ca. 1300 m., on humus (*H. Ochi* 2591). Kimotsuki-gun, Sada-machi (*Horikawa*, in herb. Hiroshima Univ. no. 11252). Prov. Hyuga, Higashi-usuki-gun, ca. 1200 m., on soil (*Amakawa*, 487, in herb. Ochi, no. 6064). Prov. Higo, near Hitoyoshi-shi, on moist rocks, ca. 60-500 m. (*Mayebara*, 162, 1630, 2075, 3484, in herb. Ochi, no. 3618, 3811, 5036, 5098). Minamata-shi, ca. 160 m. (*Horikawa*, in herb. Hiroshima Univ., no. 11374). Prov. Hizen, Saseho (*Fujiura*, in herb. Ochi, no. 6065). Nagasaki (*Wichura*, type of *B. Wichurae*, in herb. Stockholm). Prov. Chikuzan, on soil (*Osada* 701 in herb. Ochi, no. 5045). SHIKOKU: Prov. Tosa, Aki-gun, ca. 420-460 m. (*Horikawa*, in herb. Hiroshima Univ., no. 9282). HONSHU: Prov. Nagato, Chomonkyo, 180-250 m., on humus (*Ando*, 16798, in herb. Ochi, no. 4199). Prov. Bingo, Taishaku-kyo (*S. Akagi*, in herb. Ochi, no. 703). Prov. Izumo, Matsue (*Nakanishi*, 6450, in herb. Ochi, no. 2578). Prov. Hoki, Yonago, on moist soil (*T. Nishimura*, in herb. Ochi, no. 2539). Kurayoshi, ca. 60 m., on soil (*H. Ochi* 2487, 2490). Prov. Settsu, Toyono-gun, ca. 250 m., on limestone (*Nakajima* 3688). Prov. Yamato, Yoshino-gun, on moist rock (*Nakajima*, in herb. Hiroshima Univ., no. 32473). Prov. Kai, Nishiyama-gun, Shosenkyo, 530 m., on rock (*Horikawa*, in herb. Hiroshima Univ., no 21552). Prov. Musashi, Chichibu-gun, on humus, ca. 700 m. (*Horikawa*, in herb. Hiroshima Univ., no. 21033) and 1400 m. (*Nagano*, 6089, in herb. Ochi, no. 5596). Prov. Shimotsuke, Nikko, on rocky fence (*Okamura*, in herb. Hattori Bot. Lab.).

FIJI—VITI LEVU: N. Buleti trail (*O. H. Selling*, in herb. Stockholm). 2700-3900 ft., on humus and rocks (*Greenwood* 789, 1097, 1223, in herb. Bartram).

HAWAII: Maui, on trees and ground, 4000-5000 ft. (*D. D. Baldwin* 112, 260, in herb. Bartram).

COLOMBIA: Near Zipaquira, alt. 2600-2750 m., on ground (*R. E. Schultes & P. Bell* 11480, as *B. goudotii*, in herb. Nat. Mus. Canada). Páramo de Chipaque (*R. E. Schultes* 11609, as *B. goudotii*, in herb. Nat. Mus. Canada). NEW TO SOUTH AMERICA.

Var. **latifolium** var. nov. Planta sterilis. A typo differt: planta robustior; folia major, latissima, late obovata, ad 6 × 3.6 mm., sicca saepe haud mutata, cellulis laxioribus, medianis ca. 80-110 × 25-35 μ.

TYPE. BURMA: Thaudaung, usually found on rocks of cold places, 3500 ft. (*Dickason* 6738, Dec. 1937, in herb. Bartram, ex Farlow Herb.).

Var. **longifolium** (Fl.) comb. nov. *Bryum decaisnei* var. *longifolium* Fl., Musci Fl. Buit. 2: 563. 1902-04.

SPECIMENS EXAMINED: JAPAN—KYUSHU: Prov. Higo, Ashikita-gun, 120-340 m., on rock (*Horikawa*, in herb. Hiroshima Univ., no. 11495, 11523). SHIKOKU: Prov. Tosa, Takaoka-gun (*T. Wada*, in herb. Hiroshima Univ. no. 12048, 12049). Prov. Iyo, Saijo (*Oti*, 407, in herb. Ochi, no. 2591)

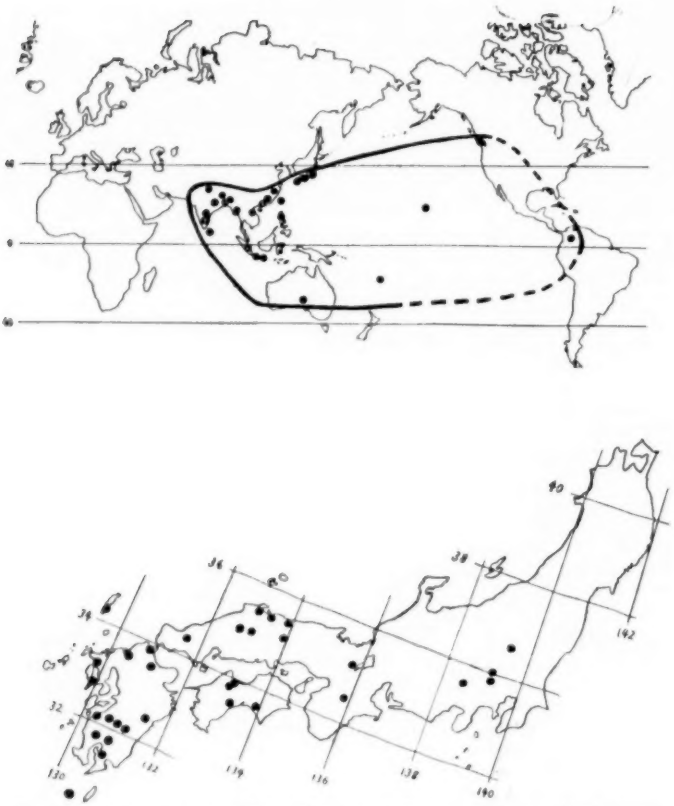

FIG. VII (*above*). World distribution of *Bryum ramosum* (including its varieties). (A circle represents localities reported in the literature but not confirmed.) FIG. VIII (*below*). Distribution of *Bryum ramosum* (including its varieties) in Japan.

HONSHU: Prov. Bingo, Tojo (*Suzuki*, 3513, in herb. Ochi, no. 1808). Prov. Yamato, Yoshino-gun (*Terao & Horikawa*, in herb. Hiroshima, no. 2001 7797). Prov. Musashi, Nishi-tama-gun, on soil (*Mizushima* 8232, in herb. Ochi, no. 5859).

DISTRIBUTION

The range of *B. ramosum* including its three varieties is shown in figure VII, with the distribution in Japan in figure VIII. Generally speaking, this species is distributed in tropical, subtropical and warm-temperate districts of Pan-Pacific and Indo-Malayan areas. I have not seen any material of this species from Africa or

Europe, and only a few specimens from Australia, Canada and Colombia, but it is possible that many unsuspected synonyms are now applied to specimens collected in those areas.

In order to understand the differentiation of this species, it is helpful to consider the relationship between water balance and habitats. *B. ramosum* is certainly a typical endohydric species, and characteristics in the costa and leaf-apices seem to be important in view of the relationship. The vigorous and nakedly long-excurrent costa which is seen in the leaves of typical *B. ramosum* and the var. *latifolium* is presumably an adaptation to warm and dry habitats where active transpiration takes place. On the other hand, the shorter and more slender costa seen in the leaves of var. *decaisnei* and sometimes also in var. *longifolium* seems to be an adaptation to be an adaptation by which a moss is capable of absorbing atmospheric moisture, such as fog and dew; mosses with this characteristic seem capable of growing in dry habitats, such as on limestone in northern or high-altitudinal places. These two types in var. *decaisnei* might better be treated under different ecological forms. At any rate, it can perhaps be said that *B. ramosum* originated in a tropical or subtropical zone, and gradually spread to other continents and islands in both southern and northern hemispheres, at last even to mild, humid districts of warm-temperate zones, such as southern Japan. In Japan var. *decaisnei* and var. *longifolium* occur sometimes in the region of deciduous broad-leaved trees. The occurrence of *B. ramosum* in Vancouver Is. in Canada is of some interest but becomes understandable if we consider the fact that the weather there is mild and not cold even in the winter.

It has been a great adventure to report here my opinions on the distribution of *B. ramosum* admittedly based on rather scanty material. I should be very happy for any suggestions and advice from readers on the distribution and classification of this species and its allies and will prepare a further treatise on the subject if more material is available.

ETHNOBRYOLOGY OF THE GOSUITE INDIANS OF UTAH

SEVILLE FLOWERS[1]

The earliest knowledge of plants in a given region is that of the native inhabitants. Indians in the western-central Rocky Mountains and the Great Basin regions were somewhat less advanced

[1] University of Utah, Salt Lake City, U.

than the tribes farther east but had a considerable knowledge of the native plants and had developed many practical uses for them. While this knowledge is apart from modern botany, it is of interest to ascertain the extent to which primitive peoples are able to advance learning of this kind.

Chamberlin (1911) published a paper on the ethnobotany of the Gosuite Indians. His study includes an account of the native plants and their uses by these people, a brief discussion of the Gosuite language and the most complete glossary of botanical terms yet assembled. Some of the mosses upon which the cryptogamic portion of the work is based are deposited in the herbarium of the University of Utah. Most of these were collected by Marcus E. Jones in the Wasatch Mountains at Alta and Brighton in 1889. The specimens were named at that time in the broadest sense as *Bryum, Hypnum* and *Polytrichum,* while the Indian names were added some time later. Except for properly identifying the mosses in this collection, the major details given here were taken from the above mentioned paper, as well as several personal conversations with Dr. Chamberlin, Professor Emeritus of Biology at the University of Utah. Dr. Charles E. Dibble, Professor of Anthropology at the University of Utah, helped with some of the details regarding Indian languages.

In Utah and the adjacent states two main linguistic peoples occupied the region, the Shoshones and the Utes. The former group was represented by Shoshone camps in southern Idaho and northern Utah, and the Gosuites in the region south and west of Great Salt Lake. These peoples all spoke the same general language with local dialects in isolated areas. The Utes occupied the region of the Colorado and Green River basins, east of the Wasatch and south of the Uinta mountains extending far into western Colorado with the related Southern Paiute Indians in the larger part of southern Utah. The languages of the Shoshones and the Utes are more or less mutually unintelligible and have been roughly compared with English and German, there being many common root words, but the combinations and inflections take on different meanings. The Navaho Indians of southeastern Utah and adjacent states speak an entirely different language which is similar to and disjunct from that of the Indians of eastern Oregon, Washington and adjacent Canada.

The language of the Shoshones is founded on monosyllabic root words which are combined in various combinations to form words or expressions. The addition of prefixes and suffixes or the contraction of two or more syllables may alter the meaning of the basic

combinations, while various inflections play no small part in rendering a precise and explicit delineation of thought.

In most instances the names of plants are surprisingly well understood throughout the region. Like common English names of plants, the Indian names are of generic character and often strongly influenced by morphological and ecological inferences. The Indians knew the lower plants in a broad general way although a few were recognized somewhat more specifically than others. Only among certain higher plants, particularly those of strong morphological features, do names reach the exactitude of our modern species.

The algae were recognized only in the broadest sense as submerged water plants, various kinds of which are included in the expression *pan-di-sip* (*pa* = water, *di-sip* = to penetrate or thrust into). The duckweed, *Lemna*, is designated by the expression *pai-ya-bo-sip* (*bo* = root). Here only the root penetrates the water. A variation of these forms is *pa-bu-ip*, indicating plants with floating or emergent leaves. Several aquatic mosses are included in these expressions but none specifically. The more specific term for mosses inhabiting water or wet places is *pá-oñ-gûp* and includes such kinds as *Distichium capillaceum, Philonotis fontana, Leptobryum pyriforme, Mnium affine, Aulacomnium palustre, Cratoneuron falcatum, C. williamsi, Polytrichum commune* and *P. juniperinum*. On the other hand, mosses growing on wet rocks are designated as *tim-pin-pá-bo-i-ûp* (*tim-pin* = rock, *bo* = root), that is, with roots on wet rocks. In this connection, lichens growing on rocks are called *tim-pin-so-kûp*, that which clings to rocks. *Polytrichum* and various matted hypnaceous mosses growing on moist or fairly damp soil are included in *pi-a-pá-oñ-gûp* (or *-gop*). Tufted mosses forming sods on soil are called *so-go-ba-gwip* (*so-go* = earth, *ba* = seed or fruit, *gwip*, a contraction of *gup* and *ip*, a small plant), that is, a small earth plant with seeds, the latter referring to the capsules of such species as *Bryum cuspidatum, Funaria hygrometrica* and other freely fruiting mosses. These same kinds are sometimes called *so-ko-ri-bo-ûmp* (*so-ko-ri* = deer, *ump* = substance serving as food), that is, a plant serving as food for deer. The terminal suffixes *-up* and *-ip* are frequent in the names of plants and imply a substance, material, thing or object of almost any sort. The root *ump* designates something edible when connected with names of plants or plant parts.

Several kinds of mosses, including species of *Philonotis, Bryum, Mnium* and various matted hypnaceous forms, were used to alleviate the pain of burns. The moss was rubbed up into a kind of

paste and applied as a poultice. These and similar forms were used as a covering for bruises and wounds or as padding under splints in setting broken bones. The moss was often kept soaked with cold or hot water. Dried moss was also used for various other purposes where padding was required.

Among the ferns of this region *Cystopteris fragilis* is the only one for which a name could be found. It is known as *pa-sa-gump*. The name may apply to other ferns, but the opportunity to test this was not presented.

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ON SOME CASES OF SINGULAR BEHAVIOR OF THE MOSS PERISTOME

A. S. LAZARENKO[1]

A connection between the hygroscopic movement of the peristome teeth and the sifting out of spores was first ascertained by Goebel (1895). Steinbrinck (1897) and Pfaehler (1904) showed it in many other species of mosses. Nearly 50 years later Patterson (1953) returned to the subject dealing with the aberrant behavor of the peristome of certain epiphytic North American mosses. Patterson reckoned that the opening of the peristome of epiphytic mosses when wet depends on their epiphytic habit.

It is generally agreed upon that the rôle of a peristome is a protective one: "The teeth of a peristome are markedly hygroscopic. In dry air they curve outward and thus make possible a sifting out of spores from the capsule. Thus, the hygroscopic movement of the teeth results in an open capsule at a time favorable for spore dispersal" (Smith, 1938, p. 108). This is true only for the small groups of mosses with a reduced double peristome (*Orthotrichum, Anacamptodon, Pterygynandrum,* etc.). The perfect double peristome of the Eubryinales, however, is customarily closed, owing to the bending down of teeth, both wet and dry. The hygroscopic movement of teeth connected with the ejection of the spores from the capsule takes place but at the changing of weather from dry to moist and vice versa.

Such a phenomenon is well observed in many epiphytic mosses, which curve their peristome teeth outward when still under the

[1] Kotziubinski-Str. 11-a,4, Lvov 5, USSR.

water film which envelops the wet peristome cone before the water is evaporated or absorbed. Here one can observe how every drop of rain sets the teeth of the peristome (of *Amblystegiella subtilis*, for instance) in vivacious motion. Hygroscopic movement of teeth takes place especially at the beginning and the end of rain, after a strong dew, when the water drops fall from the leaves of trees one by one upon the capsule. Such a behavior of a double peristome is a result of its adaptation to the liberation of spores at a satisfactory moisture condition but not at air dryness. This is not surprising when one takes into consideration the true need of mosses for moisture for the germination of spores and for their adhesion to the substratum (not only for epiphytic mosses). The difference in peristome construction plays its part in the variability of the hygroscopic motion of the peristome.

Mosses with strongly inclined or pendent capsules have their peristomes well developed and mostly double, while those with erect or slightly inclined capsules have peristomes usually single, degenerate or lacking. It is quite evident that an erect capsule is more in need of protection from water than a pendent one over the walls of which water flows without penetrating. These considerations invalidate the opinion that the peristome first of all shields the spores from the harmful influence of moisture. Its function lies in spore dispersal.

Nevertheless the perfect double peristome turns sometimes into a hindrance for the escape of the spores, as in the case of *Heterophyllium haldanianum*. *H. haldanianum* grows on level substrata and has a comparatively large and almost erect capsule; therefore, the spore masses still remain at the bottom of the urn and cannot be forced through the mouth by the wrinkling of the capsule walls when dry, as in inclined or pendent capsules. Being closed, the double peristome of *H. haldanianum* stops the escape of spores in dry as well as in wet weather or at a change in weather either way. But the peristome teeth are here extremely fragile, and this fragility helps in a singular way, by destroying the peristome to avoid the harmful influence of a double peristome in the case of a large erect capsule. The destruction of the peristome allows the spores to escape from the capsule by means of wind in the manner of gymnostomous mosses. In figure 1 the gradual destruction of the peristome of *Heterophyllium haldanianum* is shown. After 10-20 hygroscopic movements the teeth are broken off, and the capsule becomes gymnostomous. *Heterophyllium nemorosum* has the same fragile and deciduous peristome as *H. haldanianum*.

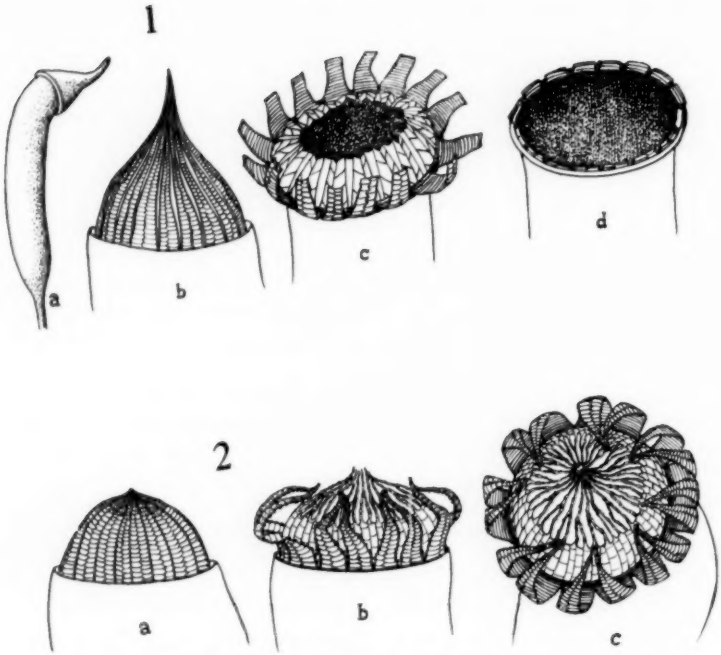

FIG. 1. *Heterophyllium haldanianum*. a. Capsule. b. Peristome right after the dehiscence of the operculum. c-d. Successive stages in the destruction of the peristome. FIG. 2. Peristome of *Timmia bavarica*. a. When wet. b. When dry. c. In motion.

Another interesting example of the aberrant behavior of the double peristome is to be found in *Timmia*. The construction of the peristome of *Timmia* is a very singular one which causes the peculiarity of its hygroscopic movement. The teeth are joined at their tips in pairs and from eight triangles, the broad and obtuse apices of which cannot penetrate inward between the cilia of the inner peristome, as in the case of the double bryoid peristome. Because of the joined apices the peristome teeth spread outward with their lower part only, whereas the apices bend inward. When the movement is begun, the teeth are not reflexed broadly but are squatted down with their spreading middles, and the apices are bent inward and skim up and down along the dome-shaped inner peristome (*fig. 2*), ploughing away the spores and jumping over the knots of the cilia. Being disturbed in this way the cilia throw out the spores. Sometimes the joined apex catches a cilium in the

loop and pulls it until it slips out attaining considerable rapidity and slinging the adherent spores very vigorously.

Thus the double peristome of the Eubryinales can be considered as a composite and perfect apparatus for the ejection of spores. This apparatus was formed as a result of an adaptation to the dispersal of spores in conditions favorable for their germination—that is, under conditions of sufficient moisture after rain or dew.

The adaptation of the peristome to the new circumstances which occurred to the plants in connection with the variability of sporophytes and the change of environmental conditions was directed by natural selection, either by the change of work modes of the peristome or its partial or even total reduction.

The double peristome of *Timmia* works very differently from that of the others: its teeth do not penetrate inward between the elements of the inner peristome. A similar behavior of the peristome teeth, without penetrating inward, was investigated by Pfaehler (1904) in *Fontinalis*. This is due to the singular modifications of the peristome structures of both of them.

A considerable reduction of the double peristome is often observed in erect capsules. *Heterophyllium* chose rather a singular way of emptying its capsule by destroying the fugacious peristome at the time of hygroscopic movement.

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FREEHAND SECTIONING OF MOSS LEAVES AND STEMS

EDWARD C. TAYLOR, SR.[1]

The following technique was developed by the writer in what may be described as a successful attempt to find a substitute for skill. It differs from methods described by Grout (1903), Hutch-

[1] Hillside Road, Woodstock, Vermont.

inson (1954) and Trotter (1955) in that not only are the stems or leaves held firmly in place, but support is given to the cutting blade throughout the cutting of a whole series of sections, so that control of the section thickness is almost automatic.

As a supporting medium for the leaves and a guide for the cutting blade, polyethylene glycols, water soluble waxes sold under the trade-mark "Carbowax,"[2] are used. Water soluble waxes in the form of stearates have been suggested by Johansen (1940) and Sass (1951), but these are not truly soluble and are not satisfactory. Polyethylene glycols have been used extensively as a substitute for paraffin in the embedding of tissues for microtoming (Blank, 1949; Blank & McCarthy, 1950; Carsten, 1947; Clark & Morishita, 1950). These waxes are marketed as liquids or solids of varying molecular weights and properties. Polyethylene glycol 600 is a soft solid below 20-25° C and a liquid above that; polyethylene glycol 1540 is a soft beeswax-like solid melting at 40-45° C; and polyethylene glycol 4000 is paraffin-like, melting at 55° C. All are readily soluble in water, giving clear and colorless solutions.

In the following description two preparations will be referred to as A and B. A is a 20% aqueous solution of polyethylene glycol 600, to which has been added a small quantity of a quaternary amine disinfectant to prevent the development of anaerobic fungi on standing. B is a mixture of equal parts of polyethylene glycols 1540 (not 1500, as in some of the articles, cited) and 4000. Either can be used alone or mixed in any proportion suiting individual taste, although straight 1540 is rather soft and 4000 crumbly. The proportion given seems to produce the best combination of smooth cutting and good support for the cutting blade.

For stems a small amount of B is placed on a slide and melted. A piece of stem is placed in the molten drop, which should cover the stem, and the wax allowed to cool. It will be cold in a minute or so if the slide is placed on a metal surface, and is then ready for sectioning. Using a quarter of a thin razor blade, preferably held in a small size X-acto knife handle, the drop is trimmed at one end to the point where sectioning is to start. The trimmed end of the drop should be vertical and at right angles to the stem. The blade is held so that the far corner of the cutting edge rests on the slide, and the cutting edge slants upwardly toward you. The blade is then moved sideways against the squared end of the drop, which serves as a guide, and is drawn from the far to the near end of the

[2] Carbide and Carbon Chemicals Company, 30 East 42nd St., New York 17.

drop with just enough lead into the wax to cut off the thinnest possible shaving. It may be necessary to trim the drop again at intervals if repeated cuts are made. Only the corner of the blade should rest on the glass, so that the cutting edge will not be dulled; and the cutting edge should be at enough of an angle so that the depth of cut being made can be seen clearly underneath it. The lateral support given the blade by the face of the drop is quite solid, and it is, for this reason, desirable to use a relatively thick drop rather than a mere film. The cut end of the drop gives guidance during the cut similar to that of a piece of wood when a thin shaving is being cut from it. Practice will soon give complete control of the thickness of the section.

Leaves which do not crisp are treated like stems. Leaves which crisp strongly will roll up in a tight ball if put directly into molten B, and others will curve so that they are difficult to cut. Such leaves require a preliminary soaking at room temperature in A, lasting until the solution has about the consistency of glycerin. The leaves can then be removed, touched to filter paper to remove excess liquid (which would soften the wax) and transferred to molten B without distortion.

The cut sections with their adhering wax are transferred to water, to which a small amount of a wetting agent may be added to keep the sections from floating. Enough water to cover the bottom of a Syracuse watch glass is preferably used, the cut sections and wax being transferred to it merely by tapping the edge of the slide on the rim of the watch glass. Since polyethylene glycol is not compatible with gelatin, the sections should stay in the water until the wax completely dissolves, which takes only a few minutes if the water is warm. The sections can then be removed and put into dilute glycerin or otherwise treated as desired.

One advantage of this technique is that, because of the guidance given by the drop, sectioning can be done under relatively high magnification with no trace of wavering of the blade. The writer commonly uses 27× or 45× under a stereoscopic microscope, but has (rather as a stunt) used 144× with the production of very thin and fine sections. Another advantage is that since the leaves are supported from all sides there is no danger of distortion from the pressure of the blade. The method works as well with dried herbarium specimens as with fresh material, although it is well to boil or soak dried plants first.

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ADDITIONAL MOSSES OF CENTRAL AND EASTERN PENNSYLVANIA

Thomas S. Githens[1]

The author has been collecting mosses for the past ten years, chiefly near Eagles Mere in Sullivan County, Pennsylvania, and in the neighborhood of Philadelphia. His private collection was not seen by Edwin T. Moul when he made his report on Pennsylvania mosses (1952), and, with the thought that a list of additional records might be useful to other collectors, the following list of 100 species is submitted. Almost all the collections were made by the author, and the numbers, unless otherwise stated, are his. For convenience of comparison, the order of genera is that used by Moul. The name of the county is followed by a more exact location except when the species was found in several places and is presumed to be of widespread distribution. The list includes only those counties not mentioned by Moul under each species.

Dicranella rufescens (Sm.) Schimp. Montgomery, limestone quarry, Conshohocken, 112.
Rhabdoweisia denticulata (Brid.) BSG. Sullivan, Castle Rock, Eagles Mere, 715.
Oncophorus wahlenbergii Brid. Monroe, Pocono Manor, 1647.
Dicranum bonjeanii DeNot. Sullivan, Keystone Observatory, 690. Monroe, Tannersville, 1763.
Dicranum drummondii C. M. Sullivan, Forksville, 1199a.
Dicranum fulvum Hook. Sullivan, Eagles Mere, 665.
Dicranum montanum Hedw. Sullivan and Montgomery.

[1] The Academy of Natural Sciences, 19th and the Parkway, Philadelphia 3, Pa.

DICRANUM RUGOSUM Brid. SULLIVAN, Crystal Lake, 697.

PARALEUCOBRYUM LONGIFOLIUM (Hedw.) Loeske. SULLIVAN, Eagles Mere, 568.

LEUCOBRYUM ALBIDUM (Brid.) Lindb. LEHIGH, Slatedale, Schaefer 79.

PLEURIDIUM SUBULATUM (Hedw.) Lindb. MONROE, Devils Creek, 1170.

TREMATODON AMBIGUUS (Hedw.) Hornsch. PHILADELPHIA, Fairmount Park, 1116.

DITRICHUM LINEARE (Sw.) Lindb. SULLIVAN, Eagles Mere, 1203.

GRIMMIA ALPICOLA Hedw. SULLIVAN, Lincoln Falls, 458.

GYMNOSTONUM RECURVIROSTRUM Hedw. SULLIVAN, Lincoln Falls, 746.

BARBULA CONVOLUTA Hedw. SULLIVAN, Wright's View, 446.

BARBULA FALLAX Hedw. PHILADELPHIA, Wissahickon Cr., 1092. SULLIVAN, Lincoln Falls, 1348a.

BARBULA UNGUICULATA Hedw. SULLIVAN, Eagles Mere, 18. MONROE, Pocono Manor, 1747a.

FISSIDENS CRISTATUS Wils. BUCKS, Quakertown, 129. SULLIVAN.

FISSIDENS OSMUNDIOIDES Hedw. PHILADELPHIA, Wissahickon Cr., 1090.

FISSIDENS TAXIFOLIUS Hedw. SULLIVAN, Eagles Mere, 423. CHESTER, Loag, 790.

ORTHOTRICHUM ANOMALUM Hedw. MONROE, Pocono Manor, 1691.

ORTHOTRICHUM OHIOENSE Sull. & Lesq. SULLIVAN, Nordmont, 1405.

ULOTA AMERICANA (P-B.) Limpr. SULLIVAN, Eagles Mere, 815.

CLIMACIUM AMERICANUM Brid. SULLIVAN.

CLIMACIUM DENDROIDES (Hedw.) Web. & Mohr. SULLIVAN.

CLIMACIUM KINDBERGII (Ren. & Card.) Grout. BUCKS, Quakertown, 130.

THELIA ASPRELLA Sull. CHESTER, Loag, 807.

MYURELLA CAREYANA Sull. LYCOMING, Zion Church, 851. SULLIVAN, Lincoln Falls, 747.

THUIDIUM VIRGINIANUM (Brid.) Lindb. MONROE, Pocono Manor, 1620a.

HELODIUM PALUDOSUM (Sull.) Aust. MONROE, Tannersville, 1760a.

LESKEA GRACILESCENS Hedw. MONTGOMERY, Schwenksville, 356. PHILADELPHIA, Wissahickon Cr., 1507.

LESKEA OBSCURA Hedw. MONROE, MONTGOMERY, PHILADELPHIA.

LESKEA POLYCARPA Hedw. CHESTER, Loag, 798. SULLIVAN, Ricketts Glen, 1179.

ANOMODON ATTENUATUS (Hedw.) Hueb. WAYNE, Starrucca, *Dix* (5/12/54).

ANOMODON MINOR (P-B.) Lindb. Delaware, Crum Cr., *Cresson* 131.

ANOMODON ROSTRATUS (Hedw.) Schimp. MONTGOMERY, Schwenksville, 508. SULLIVAN, Nordmont, 1172.

ENTODON CLADORRHIZANS (Hedw.) C. M. BUCKS, Point Pleasant, 1133.

ENTODON SEDUCTRIX (Hedw.) C. M. SULLIVAN, Beaver Lake, 729.

LEPTODICTYUM RIPARIUM (Hedw.) Warnst. SULLIVAN, Ricketts Glen, 869. MONTGOMERY, Audubon Park, 1272.

AMBLYSTEGIUM JURATZKANUM Schimp. PHILADELPHIA and SULLIVAN.

AMBLYSTEGIUM SERPENS (Hedw.) BSG. MONTGOMERY and SULLIVAN.

AMBLYSTEGIUM VARIUM (Hedw.) Lindb. MONTGOMERY.

HYGROAMBLYSTEGIUM ORTHOCLADON (P-B.) Grout. SULLIVAN, Ricketts Glen, 233.

SCIAROMIUM LESCURII (Sull.) Broth. PHILADELPHIA, Wissahickon Cr., 1125. SULLIVAN, Rocky Run, W. of Eagles Mere, 1210.

CRATONEURON FILICINUM (Hedw.) Roth. LEHIGH, Slatedale, Schaeffer 75.

CAMPYLIUM CHRYSOPHYLLUM (Brid.) Bryhn. SULLIVAN, Forksville, 1315.

CAMPYLIUM HISPIDULUM (Brid.) Mitt. MONTGOMERY, Lafayette Rd., 908. SULLIVAN, Lincoln Falls, 747a.

HYGROHYPNUM EUGYRIUM (BSG.) Loeske. CHESTER, Octoraro Cr., *Stair* (6/1/47). SULLIVAN, Eagles Mere, 1413.

HYGROHYPNUM OCHRACEUM (Turn.) Loeske. SULLIVAN, Ogdonia, 1339.

CALLIERGON CORDIFOLIUM (Hedw.) Kindb. SULLIVAN, Shady Nook, 741.

CALLIERGONELLA SCHREBERI (BSG.) Grout. MONROE, Pocono Manor, 1667.

DREPANOCLADUS ADUNCUS (Hedw.) Warnst. WAYNE, Winterdale, *Dix* (6/15/48). LEHIGH, Coplay Cr., *Pretz* 14296.

DREPANOCLADUS FLUITANS (Hedw.) Warnst. NORTHAMPTON, Danielville, *Long* 1615.

BRYHNIA GRAMINICOLOR (Brid.) Grout. SULLIVAN, Forksville, 1316.

EURHYNCHIUM HIANS (Hedw.) Jaeg. SULLIVAN, Eagles Mere, 255. MONTGOMERY, Bryn Mawr, 1228.

EURHYNCHIUM RIPARIOIDES (Hedw.) Richards. SULLIVAN, S. of Eagles Mere, 90. CHESTER, Loag, 794.

EURHYNCHIUM PULCHELLUM var. ROBUSTUM (Röll.) Jenn. SULLIVAN, Ricketts Glen, 1182. MONTGOMERY, Schwenksville, 509.

CHAMBERLAIN ACUMINATA (Hedw.) Grout. MONTGOMERY, Pennypack Park, 1504.

BRACHYTHECIUM ACUTUM (Mitt.) Sull. BUCKS, Quakertown, 128.

BRACHYTHECIUM FLAGELLARE (Hedw.) Jenn. MONTGOMERY, Lafayette Rd., 913.

BRACHYTHECIUM OXYCLADON (Brid.) Jaeg. SULLIVAN.

BRACHYTHECIUM RIVULARE BSG. SULLIVAN, Lincoln Falls, 1353.

BRACHYTHECIUM RUTABULUM (Hedw.) BSG. SULLIVAN, Nordmont, 600.

BRACHYTHECIUM SALEBROSUM (Web. & Mohr) BSG. MONTGOMERY, DELAWARE and SULLIVAN.

PLAGIOTHECIUM DEPLANATUM (Sull.) Grout. LEHIGH, Schnecksville, *Pretz* 14162.

PLAGIOTHECIUM GEOPHILUM (Aust.) Grout. SULLIVAN, Lincoln Falls, 742.

PLAGIOTHECIUM MICANS (Sw.) Par. MONTGOMERY, Audubon Park, 1278.

PLAGIOTHECIUM STRIATELLUM (Brid.) Lindb. WAYNE, Mt. Ararat, *Dix* (9/15/48).

PLAGIOTHECIUM SYLVATICUM (Brid.) BSG. MONROE AND SULLIVAN.

HYPNUM CRISTA-CASTRENSIS Hedw. SULLIVAN.

HYPNUM CUPRESSIFORME Hedw. SULLIVAN and DELAWARE.

HYPNUM CURVIFOLIUM Hedw. SULLIVAN, Sonestown, 593.

HYPNUM IMPONENS Hedw. MONTGOMERY, Youngs Ford Rd., 917.

BROTHERELLA DELICATULA (James) Fl. SULLIVAN, Ricketts Glen, 860.

HETEROPHYLLIUM HALDANIANUM (Grev.) Kindb. SULLIVAN, Nordmont, 600a.

SEMATOPHYLLUM CAROLINIANUM (C. M.) Britt. DELAWARE, Swarthmore, *Cresson* 411.

HOMOMALLIUM ADNATUM (Hedw.) Broth. MONROE, Pocono Manor, 1622. SULLIVAN, Eagles Mere, 688.

AMBLYSTEGIELLA CONFERVOIDES (Brid.) Loeske. SULLIVAN, Eagles Mere, 821. BUCKS, Catalossa Cr., 1139.

AMBLYSTEGIELLA SUBTILIS (Hedw.) Loeske. PHILADELPHIA, Wissahickon Cr., 358. MONTGOMERY, Schwenksville, 505.

PYLAISIA SELWYNII Kindb. SULLIVAN, Eagles Mere, 1211.

PYLAISIA SUBDENTICULATA Schimp. SULLIVAN, Ricketts Glen, 1178

PLATYGYRIUM REPENS (Brid.) BSG. MONTGOMERY, PHILADELPHIA and SULLIVAN.

POHLIA ANNOTINA (Hedw.) Loeske. PHILADELPHIA, Germantown, 518.

POHLIA NUTANS (Hedw.) Lindb. MONROE, Pocono Manor, 1401.

POHLIA PULCHELLA (Hedw.) Lindb. SULLIVAN, Loyalsock Cr., N. of Eagles Mere, 675.

BRYUM ARGENTEUM Hedw. SULLIVAN.

BRYUM CAESPITICIUM Hedw. SULLIVAN.

BRYUM CUSPIDATUM (BSG.) Schimp. CHESTER, Lyndell, *Trudell* (Aug. 1956).

BRYUM PSEUDOTRIQUETRUM (Hedw.) Schw. SULLIVAN.

MNIUM PUNCTATUM Hedw. MONTGOMERY.

MNIUM SERRATUM Brid. SULLIVAN, Sonestown, 1164.

MNIUM STELLARE Hedw. SULLIVAN, Forksville, 1317. LEHIGH, Weidasville, *Schaeffer* 243.

AULACOMNIUM HETEROSTICHUM (Hedw.) BSG. SULLIVAN, Forksville, 1308.

PHILONOTIS FONTANA (Hedw.) Brid. SULLIVAN, Sonestown, 413.

PHILONOTIS LONGISETA (Mx.) Britt. SULLIVAN, Forksville, 1312.

TETRAPHIS PELLUCIDA Hedw. MONTGOMERY, Youngs Ford Rd., 914.

POLYTRICHUM JUNIPERINUM Hedw. SULLIVAN, Eagles Mere, 96.

POLYTRICHUM PILIFERUM Hedw. WAYNE, Forest City, *Dix* (10/15/48).

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MOUL, E. T. 1952. Taxonomic and distributional studies of mosses of central and eastern Pennsylvania. Farlowia 4: 139-233.

OBSERVATIONS ON SPECIES OF LEPTOCOLEA

S. A. KHAN[1]

The genus *Leptocolea* is chiefly distributed over the tropical regions of Asia and America. Most of its species are epiphyllous. In East Pakistan the genus is represented by three species, *L. lanciloba* St., *L. himalayensis* Pandé & Misra and *L. mirpurensis* Khan. The first two are reported for the first time from this part of the subcontinent, and *L. mirpurensis* is a new species collected about seven miles north of Dacca.

Leptocolea mirpurensis n. sp.[2] Monoicous. Pale green plants

[1] Dept. of Botany, University of Dacca, East Pakistan.

[2] Monoica, pallido-viridis, caespitans, irregulariter valdeque ramosa. Folia ovata, imbricata, oblique patula, a brevi basi ad caulem infixa, margo antica axem transiens, apice rotunda, margine integra; folia circa 0.58 mm. longa, 0.45 mm. lata; cellulae superae 8.2 × 8.2 μ, mediae 24.6 × 16.4 μ, basales 29-37 × 16.4 μ, trigonis parvis et indistinctis; ocelli nulli; lobulus planus, mutabilis, bifidus, segmentis anguste lanceolatis, dentem hyalinum ferentibus, dens ex una cellula compositus. Gynoecium in brevi ramo insertum, bracteis ovatis, 0.37 mm. longis, apice rotundis, margine integris; lobulus triangulus, 0.06 mm. longus; perianthia pyriformis, 0.45 mm. longa, 0.32 mm. lata, rostro valido; capsula 0.14 mm. diametro. Androecium in brevi ramo insertum, bracteis 3-4 jugis, inflatis, antheridiis singulis.

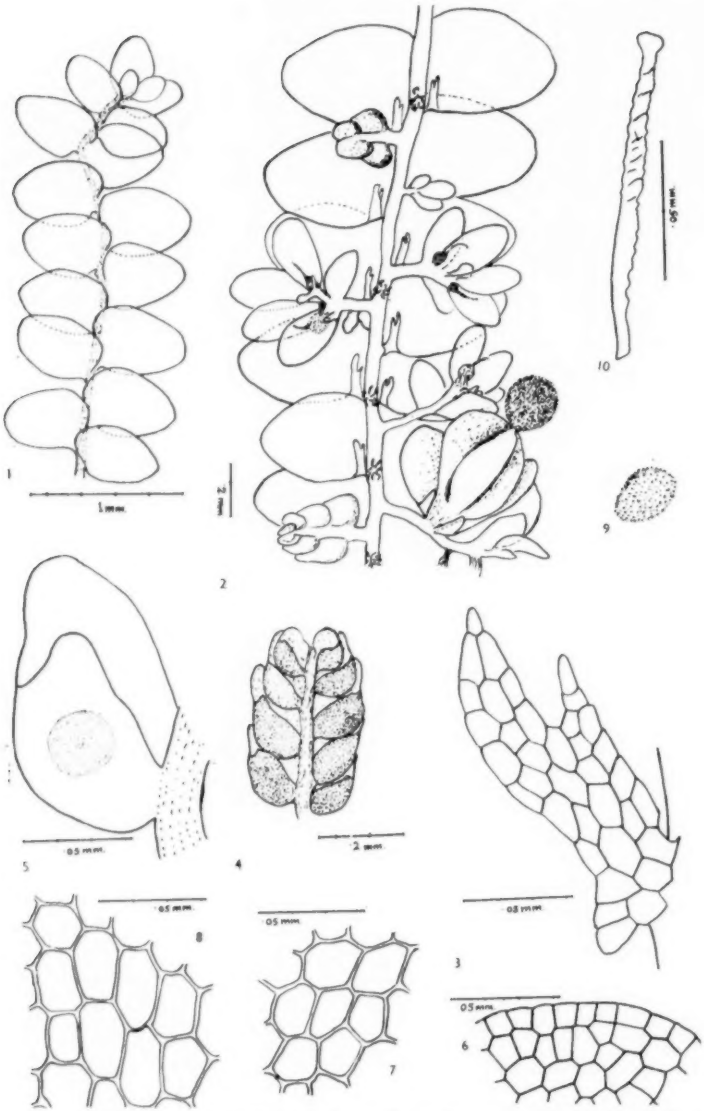

FIG. 1-10. *Leptocolea mirpurensis*. 1. Part of plant, dorsal view. 2. Part of plant with a perianth, female inflorescence and two male branches, ventral view. 3. Lobule with hyaline papilla. 4. Male shoot. 5. Male bract. 6-8. Leaf cells (6, marginal; 7, middle; 8, basal). 9. Spore, × 800. 10. Elater.

in patches, irregularly and profusely branched. Leaves ovate, imbricate, obliquely inserted on the stem by a small stalk, the antical margin crossing the axis, apex rounded, margin entire, border not hyaline, about 0.58 mm. long and 0.45 mm. wide; upper cells 8.2 × 8.2 μ, middle 24.6 × 16.4 μ and basal 29-37 × 16.4 μ; trigones small and indistinct; ocelli none; lobule plane, variable, about 0.16 mm. long, bifid, segments bearing a unicellular hyaline tooth; female inflorescence borne on a short branch, innovating; bracts ovate, 0.37 mm. long, apex rounded, margin entire; lobule triangular, 0.06 mm. long; perianth pyriform, 0.45 mm. long and 0.32 mm. wide, with a stout beak; capsule 0.14 mm. in diameter; male inflorescence on a short branch, with bracts in 3 or 4 pairs, inflated, antheridia borne singly. (Fig. 1-12.)

Epiphyllous, on dicot leaf, Mirpur forest, Dacca, East Pakistan, *S. A. Khan*, Jan. 1955 (TYPE in Botanical Herbarium, University of Dacca).

L. mirpurensis differs from other species of the genus in the shape of the lobule but has something in common with *L. lanciloba* (which has a hyaline leaf border). They both have the same general habit, are monoicous, and have similar perianths. The two species differ from each other in many features: the plants of this species are smaller than those of *L. lanciloba* and also differ in having a non-hyaline leaf border. In the latter character, *L. mirpurensis* shows some resemblance to *L. logilobula* but otherwise differs much from it. The most important feature in which *L. mirpurensis* differs from the species mentioned above is the bifid character of the lobule, and the nature of the plane lobule is striking.

LEPTOCOLEA LANCILOBA St., Hedwigia 34: 250. 1895; Sp. Hep. 5: 852. 1916. *Cololejeunea lanciloba* (St.) Evans, Trans. Conn. Acad. 10: 452. 1900. Monoicous. Plants pale green or brownish, profusely branched, the branches obliquely to widely spreading. Leaves imbricate, obliquely attached to the stem by a short stalk, antical margin crossing the stem; margin bordered by 1-3 rows of hyaline cells except at the base, apex rounded and entire; upper cells 16.4 × 18.4 μ, middle 24.6 × 32 μ, basal 24.6 × 48.2 μ; trigones indistinct or small. Lobule variable, typically lanceolate, subparallel with the stem, gradually tapering above and terminating in a 2- or 3-celled apex with a hyaline papilla at the top. Stylus 1-celled or obsolete; female inflorescence borne on a more or less elongated shoot, rarely on a very short branch, innovating, innovations floriferous, bracts similar to the leaves. Peri-

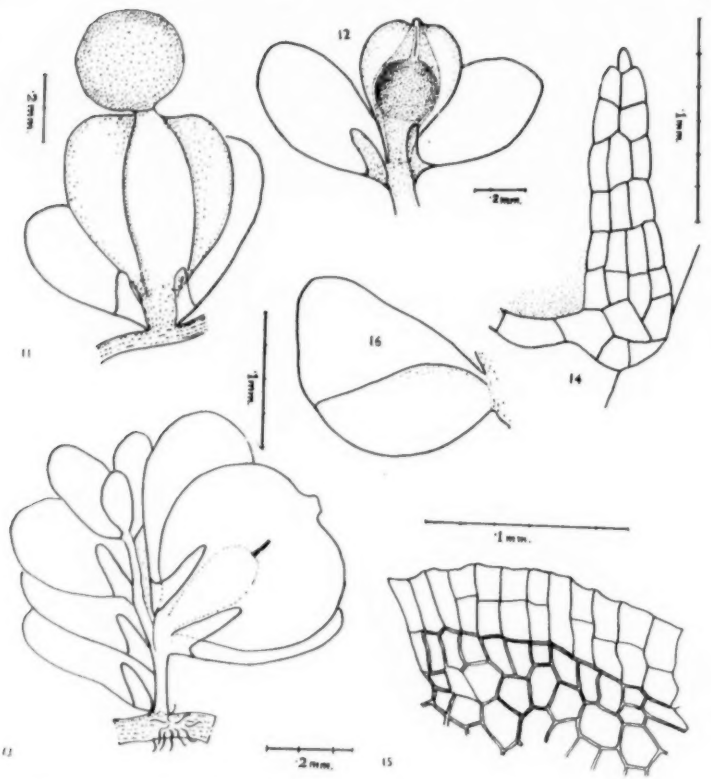

FIG. 11-12. *Leptocolea mirpurensis* (continued). Perianths, ventral view. FIG. 13-16. *Leptocolea lanciloba*. 13. Female inflorescence with a perianth, ventral view. 14. Lobule from a young part of the plant. 15. Marginal cells of the leaf. 16. Male bract.

anth obovate, 0.52 mm. long, 0.48 mm. broad below the apex; apex emarginate to obcordate, beak stout; bracts elliptical, 0.55 mm. long, 0.4 mm. wide, apex obtuse. Antheridia on long or short shoots, male bracts 4-8 pairs, smaller than the leaves, lobule broad and inflated, diandrous. (FIG. 13-16.)

Epiphyllous, on dicot leaf, Hazarikhil, Chittagong district, East Pakistan, *S. A. Khan*, Dec. 1954.

LEPTOCOLEA HIMALAYENSIS Pandé & Misra, Proc. Nat. Acad. Sci. India 13(1): 25-35. 1943. Monoicous. Pale green plants, irregularly branched, individual plants measuring about 1 cm.;

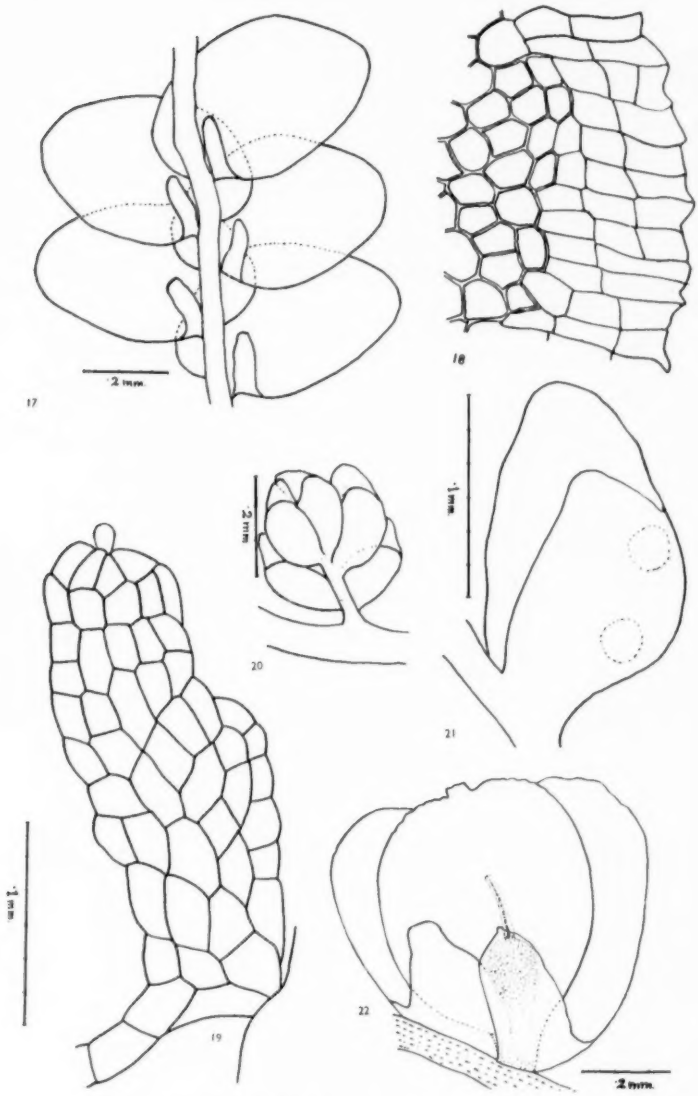

FIG. 17-22. *Leptocolea himalayensis*. 17. Part of plant, ventral view. 18. Marginal cells of the leaf. 19. Lobule. 20. Male shoot. 21. Male bract. 22. Perianth, ventral view.

leaves imbricated, horizontally spreading, obliquely inserted on the stem, the antical margin crossing the axis, bordered by 1-3 rows of hyaline cells; the lobule averaging 0.9 mm. long and 0.78 mm. broad, ovate to ovate-oblong, apex rounded, margin entire; marginal cells 18.4 × 18.4-20.5 μ, middle 24.6 × 28.7 μ and basal 26.6 × 50-53 μ lobule variable, subparallel with the stem, ovate-lanceolate, about 0.33 mm. long, the apex with a hyaline papilla; female inflorescence on a short branch, innovating; perianth pyriform with a stout beak, slightly exserted, about 0.63 mm. long and 0.51 mm. wide, the capsule about 32.8 μ in diameter; male inflorescence on a short branch, bracts in 2-4 pairs, each bract subtending 2 antheridia. (Fig. 17-22.)

[1] Epiphyllous, on dicot leaf, Hazarikhil, Chittagong district, East Pakistan, *S. A. Khan*, Dec. 1954.

I wish to accord my grateful thanks to Prof. Majeed Ahmad for his keen interest and helpful suggestions. I am also indebted to Prof. Margaret Fulford, University of Cincinnati, Ohio, for her valuable advice and criticism and to Father R. W. Timm for his Latin translation.

STUDIES IN RICCIACEAE OF EAST PAKISTAN I. NEW AND LITTLE KNOWN SPECIES OF RICCIA

S. A. Khan[1]

The genus *Riccia*, with about 140 species, is widely distributed all over the world. The species are essentially terrestrial and, requiring an abundance of water for successful growth and reproduction, are mostly restricted to moist, shaded situations. A few species, such as *R. natans* and *R. fluitans*, are aquatic, and some grow in exposed situations and are able to withstand long periods of drought. In Dacca, the genus is represented by eight species, *R. fluitans* L., *R. sanguinea* Kash., *R. discolor* L., *R. robusta* Kash., *R. melanospora* Kash., *R. perssonii* Khan, *R. arnellii* Khan and *R. bengalensis* Khan. The first five species are reported for the first time from this part of the subcontinent; the last two are new, and *Riccia perssonii* has only recently been discovered and described as a new species.

R. arnellii is of interest because of the striking arrangement of the spores in tetrads. The spores remain permanently united, and each sporogonium contains two types of tetrads. Most of them are tetrahedral but a few are rhomboidal, with all the spores in the

[1] Dept. of Botany, University of Dacca, East Pakistan.

tetrad lying in one plane. Such a feature has not been reported for any other species of *Riccia*.

Riccia arnellii n. sp.[2] Dioicous. Green plants in rosettes about 10 mm. in diameter, sometimes crowded together and overlapping; thallus once or twice forked, thin, about 7 mm. long and 2 mm. broad; lobes oblong, margin crenulate and sometimes undulating; large indefinite air pores forming pits all over the dorsal surface visible to the naked eye. Cross-section 4 or 5 times as broad as high. Male plants small, antheridia bi- or triseriate, antheridial papillae prominent. Archegonia biseriate along the mid-dorsal line of the thallus. Sporogonia numerous, spherical, projecting ventrally in a single row or sometimes in two rows; the size of the sporogonium varies greatly, as does the number of tetrads which it contains; within each sporogonium all the tetrads more or less of the same size and color; spores brown, permanently united in tetrads; tetrads variously modified in shape as a result of their mutual contacts; majority tetrahedral, measuring 66.6 μ in diameter, a few rhomboidal, measuring 69 × 56 μ; spines short and blunt. (FIG. 1-5.)

On soft and moist soil shaded by herbaceous plants, Zinzera, Dacca, East Pakistan, *S. A. Khan* 2, Feb. 1953 (TYPE in the Herbarium, University of Dacca).

With respect to its spore-tetrad types, *R. arnellii* occupies a position intermediate between *R. curtisii* and *R. perssonii*. In its tetrahedral tetrads, the species shows some resemblance to *R. curtisii*, but the tetrads are much larger than those of *R. curtisii*, and the thallus is thin. On the other hand, with respect to its rhomboidal tetrads, the species has something in common with *R. perssonii*. Although they differ in many important respects, both species have the four spores in the tetrad permanently united in just one plane. However, the presence of both tetrahedral and the rhomboidal tetrad are striking in *R. arnellii*. The species is named in honor of the distinguished hepaticologist, Dr. Sigfrid Arnell of Sweden.

Riccia bengalensis n. sp.[3] Monoicous. Bright blue-green plants

[2] Dioica. Planta viridis, clara. Frons ca. 7 mm. longa et 2 mm. lata, 1-2-furcata, antice porosa; margine crenulata; squamae nullae. Sporae brunneae, permanenter in tetradibus cohaerentes, tetrades plerumque tetrahedrae, ca. 66.6 μ diametro, rare rhomboideae, ca. 69 × 56 μ. Sporae spinosae, spinae breves hebetesque.

[3] Monoica. Planta clara, dilute glauco-viridis. Frons ca. 23 mm. longa et 5-7 mm. lata, 2-3-furcata, apice obtusa, margine leviter undulata, profunde sulcata, antice plano-convexa, postice convexa. Squamae semilunares, hyalinae vel puniceae, marginem haud excedentes. Sporae nigro-brunneae vel nigrae, ca. 100-128 μ diametro, reticulatae, areolae 11-18 μ diametro, papillae ad aerolarum angulum positae.

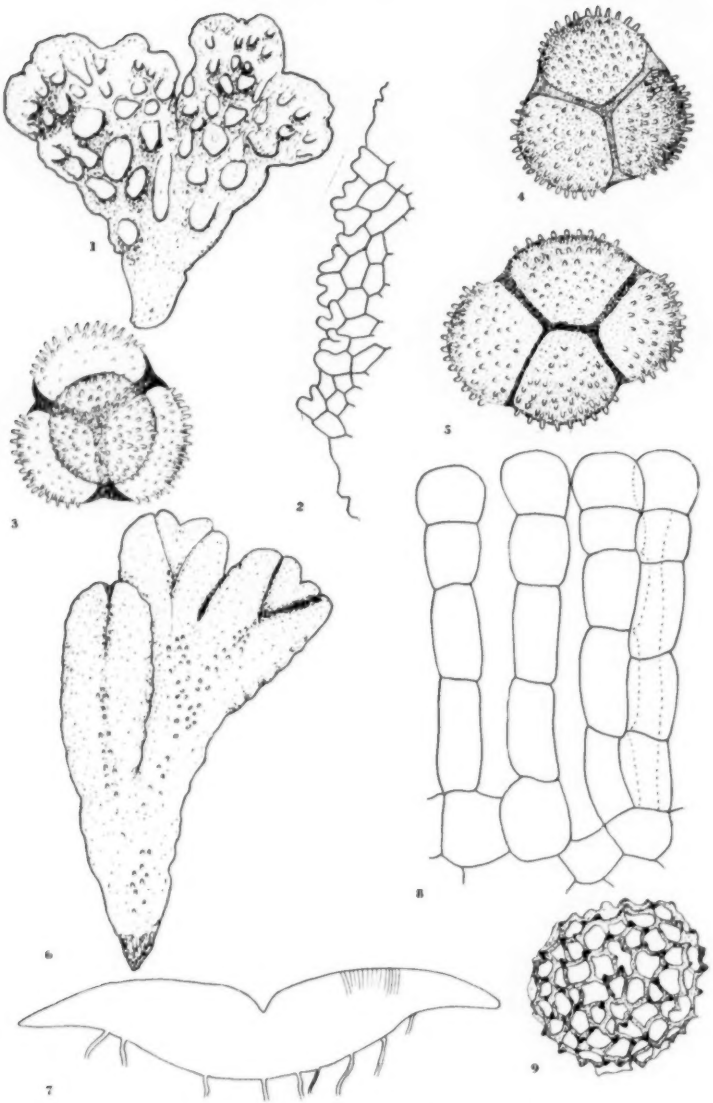

FIG. 1-5. *Riccia arnellii*. 1. Plant showing large indefinite pores, dorsal view, × 28. 2. Thallus margin, × 200. 3, 4. Tetrahedral tetrads, × 780. 5. Rhomboidal tetrad, × 780. FIG. 6-9. *Riccia bengalensis*. 6. Plant showing

overlapping in dense patches, occasionally forming rosettes, about 3-4 cm. in diameter, twice or thrice dichotomously divided with branches up to 23 mm. long and 5-7 mm. broad; apex obtuse, with median sulcus; margin slightly undulating (the breadth varying in the same plant). Cross-section 5 or 6 times as broad as high, showing a thicker central part which gradually passes on to broad thin wings. Epidermal cells dome-shaped, hyaline, sometimes destroyed. Air chambers small, narrow and slit-like. Ventral scales semilunar, colorless or pinkish, hardly extending beyond the margins. Rhizoids both smooth and tuberculate Antheridial papillae prominent, non-hyaline; antheridia 2- or 3-seriate near the apex. Archegonia large, 2- or 3-seriate; archegonial neck long, projecting, about 350 μ long, becoming brownish after fertilization. Sporogonia in mid-line, numerous, slightly protruding ventrally. Spores dark brown to dark, measuring about 100-128 μ in diameter; margin crenate; reticulum forming areoles about 11-18 μ in diameter with papillae arising from angles of areoles. (FIG. 6-9.)

On damp and shady soil, Balda Garden, Dacca, East Bengal, Pakistan, *S. A. Khan* 3, Aug. 1951 (TYPE in the Herbarium, University of Dacca).

R. bengalensis is another interesting species which is fairly large and robust. The large size of the plant, the long antheridial papillae, the large archegonium and the long projecting archegonial neck visible even to the naked eye separate this from the other species of *Riccia*.

RICCIA FLUITANS L., Sp. Pl. 1139. 1753. Monoicous. Plants yellowish-green, both terrestrial and floating. Spores brownish-yellow, ca. 65-70 μ in diameter, reticulate, margin 4-8 μ broad, finely dentate.

On stream banks or floating on stagnant water, Dacca, Sylhet, East Pakistan, collected July 1952.

RICCIA DISCOLOR L. & L., Pugillus 4: 1. 1832. *R. himalayensis* St. ex Kash., Jour. Bom. Nat. Hist. Soc. 24: 349. 1916. Monoicous. Plants dark green. Spores dark brown, reticulate, ca. 90-100 μ in diameter.

Dacca and common in plains of East Pakistan, collected July 1952.

RICCIA MELANOSPORA Kash., Liverworts West. Himalayas and Punjab Plain, Pt. I, p. 94. 1929. Monoicous. Plants green or

projecting archegonial necks, dorsal view, × 7. 5, 7. Cross-section of thallus, × 38. 8. Portion of thallus showing assimilatory filaments and air spaces × 200. 9. Spore, × 418.

grayish-green, small, usually once forked. Spores black, opaque, ca. 80-88 μ in diameter.

Balda Garden, Dacca, East Pakistan, collected Aug. 1952.

RICCIA ROBUSTA Kash., Jour. Bom. Nat. Hist. Soc. 24: 348. 1916. Monoicous. Plants yellowish-green forming rosettes. Large indefinite pores forming pits all over dorsal surface. Spores yellowish-brown, reticulate, reticulation sometimes incomplete, 70-77 μ in diameter, wing 2-4 μ broad, margin finely dentate.

On soft mud or on stream banks, Balda Garden, Dacca, East Pakistan, collected Nov. 1953.

RICCIA SANGUINEA Kash., Jour. Bom. Nat. Hist. Soc. 24: 349. 1916. Dioicous. Male plants small, forming red rosettes. Female plants large, forming dark green rosettes. Spores dark brown to dark, opaque, with wavy streaks on the wall, 50 μ in diameter.

On stream banks, Zinzera, Dacca, East Pakistan, collected Dec. 1954.

RICCIA PERSSONII Khan, Sv. Bot. Tidskr. 49: 433-436. 1955. Dioicous. Male plants (not observed before) small, forming rosettes; thallus linear, once forked; antheridia in 2 or 3 rows, antheridial papillae prominent and hyaline. The presence of 1 or 2 tetrahedral tetrads in the sporogonium has also been observed.

HEPATICAE COLLECTED IN NEVADA BY ELVA LAWTON IN 1955

LOIS CLARK[1]

Nevada is the sixth state of the United States in size and virtually unknown as to its liverwort flora. The only reports of Nevada Hepaticae known to us are those of Watson (1871) and Underwood (1884). The former mentioned three species named by C. C. Frost: *Conocephalum conicum*, *Marchantia polymorpha* and *Riccia crystallina*. The latter reported *Riccia frostii*.

Nevada occupies the central portion of the desert region west of the Rocky Mountains and thus is not a promising field for Hepaticae. Yet even dry regions have their wet spots. The chief factors limiting the liverwort flora seem to be the amount of rain-

[1] University of Washington, Seattle. This work was made possible by a grant from the Biological and Medical Research Fund of the State of Washington and a collecting grant from the Anderson Research Fund of the University of Washington.

fall and the dryness of the air. The national forests in the state include by far the most of the timber and are found chiefly in the higher, cooler and consequently rainier regions. In most of the state the altitude is approximately a mile, but in the scattered mountain ranges altitudes up to 13,145 feet occur. It follows that most of the Hepaticae were found in the national forests.

The Hepaticae were collected by Dr. Elva Lawton, bryologist, of Hunter College, accompanied by Dr. Grace E. Howard, lichenologist, of the University of Washington. Travelling was by automobile; collections within Nevada were made June 11 to July 27 and deposited in the herbarium of the University of Washington.

ASTERELLA LUDWIGII (Schw.) Underw. ELKO CO., Humboldt Nat. Forest, Ruby Mts.: Lamoille Canyon, 5 mi. from Thomas Canyon, near Harrison Guard Station, June 15 (*2651*); Angel Lake, alt. 8000 ft., June 19 (*2692*).

ASTERELLA SACCATA (Wahl.) Evans. ELKO CO., Humboldt Nat. forest, Ruby Mts.: Lamoille Canyon, 5 mi. from Thomas Canyon, near Harrison Guard Station, June 15 (*2652*); Thomas Canyon, near Lamoille Canyon, at waterfall, June 14 (*2644*).

CEPHALOZIA MEDIA Lindb. WASHOE CO., Mt. Rose, east of summit, alt. about 8000 ft., in mountain meadow, July 26 (3084) and in packets of *Chiloscyphus pallescens* (3083, 3092).

CEPHALOZIELLA ALPINA Douin. WHITE PINE CO., Nevada Nat. Forest: Snake Mts., Baker Creek, 0.5-1 mi. upstream from Snow Cabin, alt. 7500-7900 ft., July 2 (*2822*). We know of this otherwise in America only from Idaho.

CEPHALOZIELLA BYSSACEA (Roth) Warnst. WHITE PINE CO., Nevada Nat. Forest: Snake Mts., in and along Snake Cr., about 12 mi. from Nevada-Utah state line, near old miners' cabin, July 4 (*2858*) and in packet of *Leiocolea bantriensis* (*2866*) from same place.

CHILOSCYPHUS PALLESCENS (Ehrh.) Dum. ELKO CO., S.W. of Mountain City: Humboldt Nat. Forest, along Cr. west of Jack Creek Guard Station, June 22 (*2706*); just outside entrance to Humboldt Nat. Forest, where Schoonover Cr. joins Jack Cr., June 22 (*2718*). WHITE PINE CO., Nevada Nat. Forest: Shell Cr. Range, near Timber Cr. camp ground, along Cr., June 28 (*2769*); Baker Cr., 0.5-1 mi. upstream from Snow Cabin, alt. 7500-7900 ft., July 2 (*2822*), intermingled with *Cephaloziella alpina*; on rocks in and beside Snake Cr., about 12 mi. from Nevada-Utah state line, near old miners' cabin, July 4 (*2866b*) and in packet of *Lophozia minor* (*2855*). NYE CO., Toiyabe Nat. Forest Toquina Range, east of Mt. Jefferson, along Pine Cr., near camp ground, July 18 (*2985*). WASHOE CO., Mt. Rose, east of summit, alt. about 8000 ft., in mountain meadow, July 26 (3083, 3085, 3087, 3089, 3091, 3092) and in packet of *Scapania irrigua* (3086).

FRULLANIA FRANCISCANA Howe. WHITE PINE CO., Nevada Nat. Forest, Snake Mts., Baker Cr., 0.5-1 mi. upstream from Snow Cabin, alt. 7500-7900 ft., July 2, as a fragment in packet of *Cephaloziella alpina* (*2822*). This station is the farthest east known to us.

ISOPACHES BICRENATUS (Schrad.) Buch. WHITE PINE CO., Nevada Nat. Forest, Schell Cr. Range, near Timber Cr. camp ground, along Cr., June 28 (*2769a*) and in packet of *Chiloscyphus pallescens* (*2769*). This is the most southern locality known to us.

JUNGERMANNIA CORDIFOLIA Hook. WHITE PINE Co., Nevada Nat. Forest, Snake Mts., on rocks in Baker Cr., 0.5-1 mi. upstream from Snow Cabin, alt. 8000 ft., July 3 (2840).

LEIOCOLEA BANTRIENSIS (Hook.) Joerg. WHITE PINE Co., Nevada Nat. Forest, Snake Mts., in and along Snake Cr., about 12 mi. from Nevada-Utah state line, near old miners' cabin, July 4 (2866).

LOPHOCOLEA MINOR Nees. WHITE PINE Co., Nevada Nat. Forest, Schell Cr. Range, near Timber Cr. camp ground, along Cr., June 28 (2772); Snake Mts., on rocks in and beside Snake Cr., about 12 mi. from Nevada-Utah state line, near old miners' cabin, July 4 (2855) and in packet of *Leiocolea bantriensis* (2866).

LOPHOZIA ALPESTRIS (Schleich.) Evans. ELKO Co., Humboldt Nat. Forest, Ruby Mts., Angel Lake, alt. 8000 ft., June 19 (2694).

LOPHOZIA INCISA (Schrad.) Dum. WASHOE Co., Mt. Rose, east of summit, altitude about 8000 ft., in mountain meadow, July 26, in packet of *Chiloscyphus pallescens* (3083).

LOPHOZIA PORPHYROLEUCA (Nees) Schiffn. WHITE PINE Co., Nevada Nat. Forest, Snake Mts., on rocks in and along Snake Cr., about 12 mi. from Nevada-Utah state line, near old miners' cabin, July 4 (2859) and in packet of *Cephaloziella byssacea* (2856); in and beside Baker Cr., 0.6-1 mi. upstream from Snow Cabin, alt. 8500-9000 ft., July 3 (2825).

LOPHOZIA VENTRICOSA (Dicks.) Dum. ELKO Co., Humboldt Nat. Forest, Ruby Mts., Angel Lake, alt. 8000 ft., June 19 (2695). WHITE PINE Co., Nevada Nat. Forest, Snake Mts.; in and beside Baker Cr.; 0.5-1 mi. upstream from Snow Cabin, alt. 8500-9000 ft., July 23 (2825, 2830, 2844); also 0.5-1 mi. downstream from Baker L., alt. 8500-9000 ft., July 3 (2844).

MARCHANTIA POLYMORPHA L. ELKO Co., Humboldt Nat. Forest, Ruby Mts., Angel Lake, alt. 8000 ft., June 19 (2695a) and in packet of *Lophozia ventricosa* (2695); SW. of Mountain City, west of Jack Creek Guard Station, along Cr., June 22 (2705); and just outside entrance to Humboldt Nat. Forest where Schoonover Cr. joins Jack Cr., June 22 (2919). WHITE PINE Co., Nevada Nat. Forest, Schell Cr. Range, near Timber Cr. camp ground, along Cr., June 28 (2771); Snake Mts., Baker Cr., 0.5-1 mi. upstream from Snow Cabin, alt. 7500-7900 ft., July 2 (2705). NYE Co., Toiyabe Nat. Forest, Toquima Range, E. of Mt. Jefferson, along Pine Cr., near camp ground, July 18 (2995). Ormsby Co., E. of Lake Tahoe, along highway 28 about ½ mi. from junction with highway 50, July 27 (3109).

NARDIA GEOSCYPHUS (DeNot.) Lindb. ELKO Co., Humboldt Nat. Forest, Ruby Mts., Angel Lake, alt. 8000 ft., June 19 (2693).

PLAGIOCHASMA WRIGHTII Sull. ELKO Co., Humboldt Nat. Forest, Ruby Mts., Lamoille Canyon, between Thomas Canyon and Harrison Guard Station, June 16 (2674). This station is the most northerly one known to us.

PORELLA ROELLII Steph. DOUGLAS Co., Toiyabe Nat. Forest, along stream flowing into Lake Tahoe, highway 50, ⅛ mi. N. of tunnel through Cave Rock, on rocks, July 25 (3055).

RICCARDIA PALMATA (Hedw.) Carroth. WHITE PINE Co., Nevada Nat. Forest, on N. side of Lehman Cr. about 1 mi. upstream from camp ground, June 30 (2787).

RICCARDIA PINGUIS (L.) S. F. Gray. WHITE PINE Co., Nevada Nat. Forest: Schell Cr. Range, near Timber Cr. camp ground, along Cr., June 28 (2770); Snake Mts., in and along Snake Cr., about 12 mi. from Nevada-Utah state line, near old miners' cabin, July 4, in packet of *Chiloscyphus pallescens* (2866b).

RICCIA FROSTII Aust. ORMSBY CO., E. of Lake Tahoe, along highway 28, about ½ mi. from junction with highway 50, July 27 (3110).

RICCIA SOROCARPA Bisch. ELKO CO., Humboldt Nat. Forest, Ruby Mts., Angel Lake, alt. 8000 ft., June 18 (2683).

RICCIA TRICHOCARPA Aust.? ORMSBY CO., E. of Lake Tahoe, along highway 28 about ½ mi. from junction with highway 50, July 27 (3111).

SCAPANIA IRRIGUA (Nees) Dum. WASHOE CO., Mt. Rose, E. of summit, alt. about 8000 ft., in mountain meadow, July 26 (3086, 3088, 3090) and in packets of *Chiloscyphus pallescens* (3085, 3087, 3092).

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THE LOBARIA AMPLISSIMA-L. QUERCIZANS COMPLEX IN EUROPE AND NORTH AMERICA

MASON E. HALE, JR.[1]

One of the more conspicuous epiphytic lichens in Europe is *Lobaria amplissima* (Scop.) Forss. Scopali described the species in 1772, and there has since been little confusion as to its proper identity. A common lichen very closely resembling *L. amplissima* was early collected in eastern North America and described as *Lobaria quercizans* by Michaux in 1802. Although this name was legitimate, all American lichenologists persisted in calling the plant *L. amplissima* because of its superficial resemblance to the European species. The Swedish lichenologist Degelius (1935, 1940) was one of the first to point out that North American specimens differed in several respects from the typical European *L. amplissima:* namely, in thickness and color of the thallus and in lack of cephalodia. Although American lichenologists have recently adopted Degelius' conclusion that *L. quercizans* is amply distinct from *L. amplissima*, the present writer decided to clarify more fully the nature and significance of differences between these two common lichens.

[1] Dept. of Biology, West Virginia University, Morgantown, W. Va.

Herbarium specimens from the following institutions were examined and annotated: Riksmuseum, Stockholm (S); Farlow Herbarium (FH); Missouri Botanical Garden (MO); West Virginia University (WVA); Yale University (YU); National Fungus Collection (BPI); Smithsonian Institution (US); and Wellesley College (WELC). The co-type of Michaux was kindly loaned by Uppsala University (UPS).

Nomenclature

The present nomenclatural status of the two entities is outlined below with lists of exsiccata examined in the course of the study.

Lobaria amplissima (Scop.) Forss. (1883).

Synonymy: *Lichen amplissimus* Scop., Fl. Carn. 386. 1772. *L. laciniatus* Huds., Fl. Angl. 449. 1762 (*non* Trev.); *L. glomeruliferus* Lightf., Fl. Scot. 853. 1792. Exsiccata examined: *Erb. Critt. Ital. Ser.* II. 963 (*sub nom. Sticta glomerulifera*); *Flora Lusit. Exs.* 1118 (*sub nom. Imbricaria perlata* b. *ciliata*); Rabenhorst, *Lich. Europ.* 189; Arnold, *Lich. Exs.* 1217b; Anzi, *Lich. rar.* 372; Malme, *Lich. Succ. Exs.* 733; *Krypt. Exs. Vind.* 1661 (*sub nom. Sticta laciniata*); Koerber, *Lich. sel. Germ.* 365.

All earlier authors have similar descriptions of this lichen with specific mention of the fruticose cephalodia which were thought to have some sexual function.

Lobaria quercizans Michx., Fl. Amer. Bor. 324. 1803.

Synonym: *Parmelia quercizans* (Michx.) Ach., Lich, Univ. 464. 1810 (diagnosis copied verbatim from Michaux); *Lobaria amplissima* Amer. auct. Exsiccata examined (all except the last *sub nom. Lobaria* or *Sticta amplissima*): Arnold, *Lich. Exs.* 1217; Merrill, *Lich. Exs.* 143; Macoun, *Canad. Lich.* 108; Cummings, *Lich. Amer. Bor.* 36 and *Decades N. A. Lich.* 62; Tuckerman, *Lich. Amer. Sept.* 105; Thomson, *Lich. Wisc. Exs.* 17; Hale, *Lich. Amer. Exs.* 53.

The co-type of *Lobaria quercizans* Michx. *in herb.* Agrelii (*ex herb.* Achariano) is identical with North American specimens, as Du Rietz had previously discovered. Co-types presumably deposited at Paris and Geneva have unfortunately not been located. According to Dodge (*in lit.*), Michaux's collections from the mountains of North Carolina consisted of a mixture of *L. quercizans* and the equally common *Sticta beauvoisii* Del. [*St. weigelii* (Ach.) Vain.]. This latter plant has been called *Sticta quercizans* (Michx.) Ach. (*non* Del.) in the older literature. In his brief diagnosis Michaux referred to apothecia of *L. quercizans* as "fuligineo-fuscis," an obvious character in the North American material. Apothecia are extremely rare in *Sticta weigelii*. He also mentioned a variety with crisped margins, possibly a reference to the dense marginal sorediate isidia of *St. weigelii*. If the other type collections are located and proved to contain a mixture, it will be necessary to emend *Lobaria quercizans* to exclude material belonging to the genus *Sticta*.

Distribution

Degelius (1935) studied in detail the distribution of *Lobaria amplissima* in Europe and Scandinavia. The species is strictly oceanic in Scandinavia but farther south (Germany to the Medi-

terranean) it occurs widely inland, though still more frequently near the coasts. *L. quercizans* in North America has a typical Appalachian-Great Lakes distribution pattern (Fig. 1) where it is most abundant in mature conifer-hardwood forests with *Lobaria pulmonaria*.

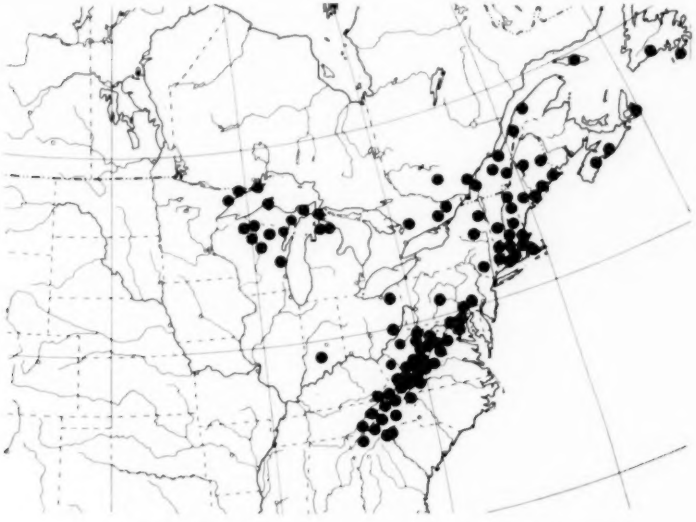

FIG. 1. Distribution of *Lobaria quercizans* in North America.

MORPHOLOGY

The external features of *Lobaria amplissima* and *L. quercizans* are very similar. Degelius (1940) reported that the European specimens have a paler color than those in North America which usually retain a greenish-yellow long after preservation. Although this criterion may be valid, an analysis of several hundred specimens by the writer failed to offer a satisfactory means of classifying the tenuous color differences. Degelius found that *L. amplissima* is considerably thicker (475-645 μ) than *L. quercizans* (195-230 μ). The present writer measured the thickness of 50 mature specimens of each species. *L. amplissima* has an average thickness of 425 μ with a range of 295-610 μ; *L. quercizans* has an average thickness of 320 μ with a range of 195-500 μ. While there is a considerable overlap of values, the means appear significantly different.

Degelius also measured the height of the hymenium, and as expected *Lobaria amplissima* had a higher hymenial layer than *L.*

quercizans. The writer did not further investigate this character but did analyze the frequency of apothecia. *L. amplissima* had apothecia in 36% of a sample of 100 specimens. In a comparable sample of the North American population apothecia occurred with a frequency of 95%.

A third morphological character, presence of fruticose cephalodia, was recognized by lichenologists in the late eighteenth century. These cephalodia are classified as *Dendriscocaulon umhausense* (Auersw.) Zahlbr. They may be an organic part of the lichen thallus, sprouting in conspicuous dark patches from between the lobes (*cf.* photograph in Dughi, 1936), or they may rarely grow on bark autonomously. In the European sample, 63% of the specimens have cephalodia. No North American thalli have cephalodia, though one case was reported by Forssell (1883). In any event cephalodia are common in Europe but virtually lacking in North America.

Chemical Components

The lichen substances in *Lobaria amplissima* and *L. quercizans* have never been thoroughly investigated. Degelius (1940) found no chemical differences between the two species, yet failed to mention what, if any, substances were present. The medulla of *L. quercizans* turns instantly blood red when treated with calcium hypochlorite (C). Both microchemical tests with Asahina's methods and analyses of extracts with chromatography proved that the C reaction is caused by gyrophoric acid (Hale, 1956), which is present in all North American specimens. The European *L. amplissima* is negative with C, but if potassium hydroxide is applied with C, a weak transient red color appears. A white residue is easily extracted from the thallus with ether, and dense radiate clusters of needles quickly precipitate from acetic acid or alcohol in microchemical tests. This substance has an Rf value of .93 (n-butanol saturated with ammonia, 4:1), much higher than Rf values of the other KC red acids (physodic, alectoronic and lobaric). Prof. Asahina (1947 and *in lit.*) had previously discovered the same substance in *Lobaria verrucosa*. Although samples of the new acid are not yet available in quantity for chemical analyses, Asahina has suggested that it is an undescribed orcinol depsidone related to alectoronic acid.

Summary

Lobaria amplissima in Europe and *L. quercizans* in North America are common epiphytic lichens with similar external appearance. Many lichenologists have considered them to be identical. *L. amplissima*, however, has a thicker thallus (425 μ), a high frequency of cephalodia (63%) and a low

frequency of apothecia (36%). *L. quercizans* has a thinner thallus (320 μ), no cephalodia, and a high frequency of apothecia (95%). Although the average morphological differences are measurably distinct, a number of specimens from the two continents are indistinguishable.

The chemical components of the two populations are constantly different: *L. amplissima* contains an undescribed orcinol depsidone (KC red); *L. quercizans* contains gyrophoric acid (C red).

The morphological differences, correlated with the production of different acids, seem sufficient to maintain the two entities as distinct species.

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THE 1956 FORAY OF THE AMERICAN BRYOLOGICAL SOCIETY

JOHN W. THOMSON[1]

A really successful foray in the New England mountain country was led by Mrs. Ethel Hutchinson of "Brighthollow," Canaan, New Hampshire, helped by Mrs. Betty Sherrard and Hannah Croasdale of Dartmouth College. Totaling up the members and their families, plus a couple of members who arrived late after mistaking Canaan, Vermont, for Canaan, New Hampshire, the attendance was forty-seven, perhaps a record number. In addition to the American members of the Society, the presence of Dr. and Mrs. Persson of the Riksmuseets Paleobotaniska Avdelning at Stockholm and Mrs. Togosaki of Japan, added an international flavor to the group. England was represented by Miss Jane Taylor.

On the morning of August 24th, the weather was wet and rainy, breaking a several weeks' drought and bringing the bryophytes and lichens into the finest of conditions for the foray. The foray party

[1] Dept. of Botany, University of Wisconsin, Madison 6, Wis.

Part of the 1956 Foray group at "Oldfields": *Front, left to right.* Hannah Croasdale, Mrs. Herman Persson, Ethel Hutchinson, J. W. Thomson, Mrs. Thomson and baby, Herman Persson, Leo Koch, Walter Ainsworth. *Standing in back.* A. J. Sharp, Winona Welch, Mrs. Togosaki, Mrs. W. E. Stone, Mary L. Lamprey, Mrs. Henry Conard, Jane Taylor, Robert Giesy, Dorothy Gliddon, Frank Hilferty, T. G. Yuncker, W. H. Root, Raymond

met at the Cobb House, Canaan, where many were staying, and then drove in a caravan to a deep gorge, "Sculptured Rocks," in Groton Township, Grafton County, where the group collected in a light drizzling shower. Near noontime the caravan moved on to "Oldfields," the summer house of Miss Mary L. Lamprey, librarian of North Easton, Mass. Here, in the dark under the old barn, the party enjoyed one of the rarest treats of a bryologist's lifetime, a huge colony of the luminous moss, *Schistostega*, square yards in extent and lighting up the earthen floor with a brilliant green-gold. Yet a movement of the observer to one side—and the light was gone. No wonder it is known as goblin gold in Scandinavia, according to Dr. Persson. Many of the group returned again and again to the doorway of the barn cellar to gaze at the colony. All who desired specimens were provided with samples by the leader, Mrs. Hutchinson.

After examining the *Schistostega*, the most gracious hospitality of New England was extended to the forayers. Through the generosity of the owner of "Oldfields," Miss Lamprey, and her friend, Mrs. Charles R. Nutter of Canaan, the entire group was served a fine luncheon prepared by the members of the Ladies Aid. The ladies on the foray were also entranced by the antiques and the centuries-old home of our hostess.

The rain had by now let up and after a last look at the *Schistostega*, the foray group drove to the parking area at the base of Wildcat Gorge, Mount Cardigan. The party then climbed up the trail about a mile and three-quarters to the summit, reaching a highly interesting open, rocky "bald" near the top. Mosses which appeared in especial abundance according to Dr. Conard were, *Andreaea* sp., various *Sphagna*, *Hypnum crista-castrensis*, *H. reptile*, *Rhabdoweisia denticulata*, *Dicranum fulvum*, *D. montanum*, *D. scoparium*, *Polytrichum commune*, *P. juniperinum*, *P. ohioense*, *P. piliferum* and *Leskea* sp. The party was distributed quite far over the mountain top, but all descended by sunset to eat a picnic supper near the parking area and then to return to Canaan.

During that evening, most of the foray members went to the Canaan County Fair especially to see the most impressive exhibit

Hatcher, Mrs. W. H. Root, Edward Taylor, Geneva Sayre, Mrs. Henry Imshaug, Susan and Fred Imshaug, Henry Conard, Henry Imshaug, Mrs. Walter Ainsworth, W. E. Stone, Douglas Thomson. *Also present but not in the picture* were Betty Sherrard, Mrs. A. J. Sharp and two daughters (Mary Martha and Jenny), Gen. and Mrs. Frank Lowe, Howard Crum, Lewis Anderson, Clarence Baum, Dr. and Mrs. H. H. Holliger, John and Stefan Holliger, Norman and Roderic Thomson and Miss Martz. (*Photograph by Evelyn Sharp.*)

of over 200 living mosses, liverworts and lichens in a natural setting prepared by Mrs. Hutchinson. This completely labelled exhibit is one of the annual star attractions of the fair.

Up again early on the morning of August 25th, the group drove to Queechee Gorge of the Ottauqueechee River in Hartford Township, Windsor County, Vermont. This is a deep gorge in a limestone region and produced a number of interesting collections, *Saelania glaucescens, Buxbaumia aphylla, Encalypta ciliata* and a *Geocalyx,* being those most prized by the collectors. Although scheduled to collect elsewhere in the afternoon, the group found the Gorge so interesting that they voted to eat lunch there and continue examining the rock walls during the afternoon. In the late afternoon, they adjourned to the home of Dr. and Mrs. Sherrard in Hanover, again enjoying New England hospitality at tea on their terrace before returning to Canaan.

On the morning of the 26th, some of the members with urgent Society business drove directly to Storrs, Connecticut. Others lingered to vist "Brighthollow," the estate of our leader. Here they climbed a hill to a mica and garnet mine, collecting along the way and only reluctantly returned to the cars for the trip to the AIBS meetings at Storrs.

Altogether this was a thoroughly enjoyable and well-led foray with excellent weather and most interesting country.

THE MEETINGS OF THE BRITISH BRYOLOGICAL SOCIETY, 1956

A. C. Crundwell[1]

The annual general meeting of the Society was held at Southampton over the Easter weekend, with excursions to the bogs and woodlands of the New Forest and to the chalk of Wiltshire. The species seen included many southern ones of restricted distribution in Britain, the rarest being *Zygodon forsteri.* The discovery in Wiltshire of the endemic *Weissia sterilis* slightly extends its known range. *Campylopus introflexus* was seen in abundant fruit in two localities. The only other British station for the fruit is in southwest Ireland.

The Society met again for a fortnight in July and August at Aviemore, in Scotland. Aviemore is well placed for the Cairn-

[1] Dept. of Botany, The University, Glasgow, W. 2, Scotland.

THE MEETING AT SOUTHAMPTON. STANDING (*left to right*): T. D. Swinscow, R. Lewis, R. A. Boniface, Mrs. Warburg, J. W. Hodgetts, E. F. Warburg, Mrs. Appleyard, P. R. Bell, E. C. Wallace, A. C. Crundwell, Mrs. Wright, M. C. F. Proctor, H. Williams, Mrs. Peterken, C. N. Twydell, J. H. G. Peterken, J. H. Tallis, A. J. Pettifer, E. V. Watson, Mrs. Newbould, P. J. Newbould, L. B. C. Trotter. SEATED (*left to right*): Bill Warburg, Richard Warburg, Miss M. A. Williams, A. Pettet, D. Patterson, Miss E. M. Evans, Mrs. Paton. (*Photograph by Jean Paton.*)

gorm Mountains, the second highest in Scotland, and it was planned to spend much time high up. But not even Mr. Wallace's efficient organization of the meeting prevented it from coinciding with one of the wettest spells of a very wet summer, and during most of the time spent on the higher ground there was either thick mist or gales and driving rain. Nevertheless, we saw a fair sample of the snow-patch vegetation, dominated by *Marsupella* spp., *Nardia breidleri* and *Pleuroclada albescens*. Noteworthy plants seen on the Cairngorms included *Lophozia opacifolia* (new to Britain), *Pohlia cucullata*, *Cratoneuron decipiens* and *Plagiothecium platyphyllum*, as well as many of the rarities already known to grow there.

Perhaps the most interesting area visited was Glen Feshie, to the southwest of the main Cairngorm massif. The schist here supports a rich basic flora, in sharp contrast to the granite of the Cairngorms. It is well off the beaten track, unexplored bryologically until 1951 when Mr. Wallace went there and found *Ctenidium procerrimum*, *Hypnum bambergeri*, *Myurella julacea*, etc. Additions made on this visit included *Schistidium atrofuscum* and *Weissia wimmeriana*, both new to Britain, *Saelania glaucescens*, *Pseudoleskea catenulata* var. *acuminata*, *Rhytidium rugosum* and many others of lesser note. It is clear that Glen Feshie is one of the main British centres for calcicolous arctic-alpines.

The Monadhliath Mountains, to the West of the Cairngorms, have been much neglected; undeservedly so, for the flora was found to be quite rich and included *Calypogeia trichomanis* sensu K.M., with bright blue oil-bodies, a plant not previously known definitely from Britain. Creag Meagaidh, an isolated mountain to the southwest, yielded *Scapania paludosa* and many other interesting species, but a search for *Dicranum elongatum*, seen there in 1870, was unsuccessful.

The low ground, including the pine and birch forests, was by no means ignored. Among species new to the area were *Cynodontium gracilescens*, *Dicranum montanum* and *Plagiothecium roeseanum*. Other rarities, new to most members, were *Sphenolobus saxicola*, *Crossocalyx hellerianus*, *Buxbaumia aphylla* and *Orthotrichum speciosum*. A trip to the Culbin Sands was amply rewarded by the finding of *Haplomitrium hookeri*.

The work of the meeting added substantially to our knowledge of the bryophytes of Scotland. All those who attended it found species new to them, and all enjoyed a holiday in the congenial company of friends old and new.

REVIEWS

MUSCI JAPONICI EXSICCATI, Ser. 10 (nos. 451-500), edited by A. Noguchi & S. Hattori. Hattori Botanical Laboratory, Obi, Nichinan, Miyazaki Pref., Japan. April 1, 1956 ($7.00)—Series 10 of the *Musci Japonici Exsiccati* includes the following: 451. *Anomodon decurrens* Card. 452. *Astomum crispum* (H.) Hampe. 453. *Atrichum undulatum* v. *haussknechtii* (Jur. & Milde) Frye. 454. *Barbula unguiculata* H. 455. *Brachythecium reflexum* (Starke) BSG. 456. *Bryum erythrocarpum* Schw. 457. *Bryum wichurae* Broth. 458. *Calliergonella cuspidata* (H.) Loeske. 459. *Calyptothecium japonicum* Thér. 460. *Campylium chrysophyllum* (Brid.) Bryhn. 461. *Coscinodon cribrosus* (H.) Spr. 462. *Cyathoporella hookeriana* (Grif.) Fl. 463. *Dicranella tosaensis* Broth. 464. *Distichophyllum maibarae* Besch. 465. *Drepanocladus japonicus* Dix. 466. *Entodon tosae* Besch. 467. *Epipterygium nagasakense* Broth. 468. *Tetraphis pellucida* H. (as *Georgia*). 469. *Grimmia apocarpa* v. *microtheca* Card. 470. *Isopterygium subarcuatum* (Broth.) Nog. 471. *Leptobryum pyriforme* (H.) Schimp. 472. *Macrosporiella sapporensis* (Besch.) Nog. 473. *Mercevya ligulata* (Spr.) Schimp. 474. *Mercevopsis sikkimensis* (C. M.) Broth. & Dix. 475. *Michichhoferia japonica* Besch. 476. *Mnium speciosum* Mitt. 477. *M. spinosum* (Voit) Schw. 478. *Myurella sibirica* (C.M.) Reim. (as *M. gracilis*). 479. *Myurium rufescens* v. *yakushimense* Nog. 480. *Neckera flexiramea* Card. 481. *Philonotis falcata* (Hook.) Mitt. 482. *P. fontana* (H.) Brid. 483. *Physcomitrium japonicum* (H.) Mitt. 484. *Plagiopus oederi* (Brid.) Limpr. 485. *Pleuridium subulatum* (H.) Lindb. 486. *Pogonatum spuriocirratum* Broth. 487. *Pohlia acuminata* Hoppe & Hornsch. 488. *P. columbica* (Kindb.) Andr. 489. *Rhaphidostichum macrostictum* (Broth. & Par.) Broth. 490. *Schwetschkea robusta* Toy. 491. *Sphagnum capillaceum* (Weiss) Schrank. 492. *S. recurvum* P.-B. 493. *S. robustum* (Russ.) Röll. 494. *Taxiphyllum taxirameum* (Mitt.). Fl. 495. *Thuidium recognitum* (H.) Lindb. 496. *Tortella tortuosa* (H.) Limpr. 497. *Trematodon atrovirens* Broth. 498. *T. flaccidisetus* Card. 499. *Trichodon tenuifolius* (Schrad.) Lindb. 500. *Weissia longidens* Card.

Of the 50 taxa represented in this series, prospective purchasers will be pleased to know that 22 have not previously been distributed in these exsiccati. Only one, *Weissia longidens* (500), has been distributed twice already.

Seven are not included in Sakurai's recent (1954) *Muscologia Japonica* (453, 473, 474, 477, 487, 488, 491). Of these, only two (473, 477) are among the earlier series of the *Musci Japonici* (Ser. 9: 432, 434). Three species (485, 486, 496) are reported by Sakurai, but Japan was not mentioned in their range by Brotherus in the second edition of *Die natürlichen Pflanzenfamilien*, and so are relatively recent additions to the known moss flora of Japan.

Seventeen species are relatively common and widespread, but seven of them had not been distributed previously by Noguchi and Hattori (453, 455, 456, 469, 491, 492, 493) and the other 10 only once before (452, 454, 458, 460, 468, 471, 478, 482, 495, 496). Nine of the other 33 are relatively uncommon although known from widely scattered stations in the boreal hemisphere (461, 473, 477, 484, 485, 487, 488, 499). Of these, *Pohlia columbica* (488, *Ochi*, from Tottori Pref.) is especially noteworthy as an addition to a small but critical element of the Asia-North American Division of the boreal flora. Whereas early phytogeographers often mentioned those plants which are distributed disjunctly in Asia and eastern North America, the disjunct distribution in Asia and western North America has received scant attention. The discovery of living *Metasequoia*, however, focussed attention upon this

distributional pattern. Among the mosses in this element are *Claopodium crispifolium* (Hook.) Ren. & Card., *Girgensohnia ruthenica* (Weinm.) Kindb., *Hypnum circinale* Hook., *Lyellia lescurii* (James) Frye, *Mnium glabrescens* Kindb., *Oligotrichum aligerum* Mitt., *Rhacomitrium varium* (Mitt.) Lesq. & James and *Pogonatum contortum* (Schw.) Sull. To this brief list we may now add *Physcomitrella californica* Crum & Anderson, which has been discovered in Japan less than a year after its original description in *The Bryologist*. (See Jour. Hatt. Bot. Lab. 17:59.)

In western United States, the remarkable correspondence of the distribution of *Fissidens pauperculus* Howe, *Orthodontium gracile* B. & S. and the coast redwood (*Sequoia sempervirens*) has been recognized already. Similar investigations of the bryophyte floras of the forests dominated by the sierra redwood (*Sequoiadendron*) and the dawn redwood (*Metasequoia*), doubtless would disclose other and equally fascinating parallels in distributional patterns. From this perspective, the careful and intensive work of the Japanese bryologists, led by Drs. Hattori, Horikawa and Noguchi, is a significant contribution to bryogeography. Certainly the *Musci Japonici* will serve a critical need in the reevaluation and delineation of taxa in the floras of Asia and North America.

Of the 50 taxa listed above, 13 are listed by Brotherus as known only from Japan (451, 457, 459, 464, 466, 467, 470, 372, 475, 476, 480, 489, 500), and eight others (464, 474, 479, 481, 483, 486, 494, 498) as only Asiatic in known distribution. Some of them almost certainly will be found in North America, or will be recognized as identical with North American forms. On the other hand some mosses now considered to be endemic to western North America probably will be discovered in Japan or the Asiatic mainland, as were *Physcomitrella californica* and *Pohlia columbica*.

I am surprised that as many as 18 persons contributed specimens to Series 10 of the *Musci Japonici Exsiccati*. Perhaps the fraternity of Japanese bryologists is greater in number than is apparent in non-Japanese botanical journals. Those who contributed the most numbers to this series are K. Mayebarae (456, 457, 467, 468, 470, 485, 486, 490, 499, 500) with 10 from Kumamoto Pref. and Z. Iwatsuki (462 from Aichi Pref., 453, 476, 482, 487 from Nagano Pref., 498 from Toyama Pref., 479, 480 from Wakayama Pref.) with eight collections. Geographically, those from Hokkaido, the northernmost island in the Japanese archipelago (*Chiha* 455, 472, 495, *Ochi* 475) are especially interesting. Altogether 17 prefectures of Japan are represented in this series.

The regrettable use of pre-Hedwigian nomenclature was mentioned in a review of Series 9 and need not be elaborated again. As explained by Dr. Hattori in correspondence, the editors have not had access to the necessary literature which would have enabled them to determine the correct nomenclature. At any rate, in view of the latest decision of the International Congress to set an arbitrary starting date for muscological nomenclature (December 31, 1801), I no longer am enthusiastic about a strict application of the rules. In this predicament, perhaps, reliance upon the names used by Brotherus in the second edition of *Die natürlichen Pflanzenfamilien* may be the wisest and most practical policy.

Those bryologists who have followed the rise of interest in the so-called "copper-mosses," may be delighted to have Japanese specimens of *Mercya liqulata* (473), *Mercyopsis sikkimensis* (474), and *Mielichhoferia japonica* (475). At Storrs, Connecticut, last August, Dr. Herman Persson delivered a fascinating account of his recent research on these bryophytes. Inasmuch

as both liverworts and mosses are mentioned, the continued usage of the phrase "copper mosses" is hardly commendable. If a more appropriate technical term is to be avoided, why not call them "copper bryophytes?" Persson referred to the recent work of Dr. A. Noguchi (Kumamoto Journ. Sci. Ser. B, sect. 2, 2: 239-257. 1956) in which the genus *Mercevopsis* is reduced to synonymy under *Mercevа*. The latest number (17) of *The Journal of the Hattori Botanical Laboratory* contains a splendid account of Dr. Persson's conclusions and his review of pertinent earlier research with vascular plants as well as bryophytes. The potential utility of bryophytes in locating important deposits of mineral ores, as suggested by Persson, if realized, would certainly contribute some popular prestige to the science of bryology. An extension of this type of investigation and its consequent application in America is decidedly in order.

Congratulations once again to Drs. Noguchi and Hattori for continuing the *Musci Japonici Exsiccati* with such a fine lot of specimens and interesting taxa.—Leo Francis Koch.

Arthur L. Jewell: *The Observer's Book of Mosses and Liverworts.* 128 *pp. Pl.* 1-64 (32 *in color*). Frederick Warne & Co., Ltd., London and New York. 1955. [5 shillings]—This little book, of handy pocket size, provides attractive illustrations of 116 species of bryophytes which can be recognized in the field either with the unaided eye or with a simple lens. It is a picture book, without keys or detailed descriptions and, as such, fulfills a real need for a book useful to children or adults whose interest in bryology is limited to the pure pleasure of recognition. It is the kind of book which the layman often looks for, and I shall be pleased to recommend it for use in North America, as the species are the common and conspicuous ones either in Europe or on this continent. The illustrations are attractive, and the colored ones greatly resemble the water-color sketches of some of the classic bryological works, such as those in Hedwig's *Species Muscorum*, some of which are reproduced in Richards' admirable little *Book of Mosses* (in the King Penguin series). Included in the book are discussions of general characteristics, life cycles and methods of collection and study, as well as useful alphabetical, taxonomic and ecological indices and information on useful literature and natural history societies.

The scientific names are given for each species, and most of them are also assigned common names, which are for the most part those which have been used in the older literature and are often no more than literal translations of the Latin names. Some are very cumbersome; *Eurhynchium riparioides* seems no more difficult to me than "Long-Beaked Water Feather Moss." It would also seem easier and more helpful in building up a repertoire of species which one can recognize, if the common names represented some generic concept. For example, it must be confusing to a beginner to learn *Mnium longirostrum* as the "Long-Beaked Thread Moss" and *Aulacomnium androgynum* as the "Bud-Headed Thread Moss," as the two do not resemble one another, and there is no apparent reason for the implied relationship in the name "Thread Moss." This difficulty is clearly demonstrated by including in the "Feather Mosses" such genera as *Neckera, Thamnium, Hookeria, Thuidium, Acrocladium, Camptothecium, Brachythecium, Eurhynchium, Pseudoscleropodium, Pleurozium, Isopterygium, Plagiothecium, Hypnum, Ptilium, Rhytidiadelphus* and *Hylocomium*—in other words, nearly the whole series of pleurocarpous mosses. I would think it better to abandon the old names which are not at all appropriate in many instances and are not sanctioned by widespread usage, as the names of flowering plants often are,

and to coin new ones of some generic implication, or to avoid common names entirely and use generic names only in a broad sense (*Hypnum* to include *Ptilium, Brachythecium* to include *Camptothecium*, etc.).—H. A. Crum.

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Margaret Fulford[1]

Abramov, I. I. Species aliquantulae muscorum curiosorum e regione Leningradensi. [Bot. Materialy] Not. Syst. e Sect. Crypt. Inst. Bot. nomine V. L. Komarovii Acad. Sci. URSS 10: 240-247. *3 fig.* 1955.

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ERRATA FASCICULORUM 11-20

No. 12. (THE BRYOLOGIST 57: 300-305. 1954).

p. 302, line 45. For congiesserunt read congesserunt.

No. 13. (THE BRYOLOGIST 58: 84-90. 1955).

p. 88, line 22. Add the date 1951.

No. 20. (THE BRYOLOGIST 59: 300-303. 1956).

p. 300, line 12. Delete the entire line beginning with "*U. comosa* . . ." and insert: *U. cizancnsis* n. sp.; *U. longissima* v. *vulgata* n. v., v. *robustior* n. v.,

NEWS AND NOTES

We left January 15 on rather short notice for Springfield, Mo., to fill the vacancy in the biology department of Drury College caused by the death of our good friend Tom Parsons and expect to be absent from Lake Hamilton until June 15. Mr. Parsons was for a few years on the staff at Grinnell College, where we worked together developing a freshman biology course. When we heard by wire from the Drury president, a Grinnell alumnus, of Tom's death on Thanksgiving Day, we offered to finish his first semester's work but were not needed. They wanted us for the second semester, however, and we are dividing the teaching load between us.

—Henry S. and Louisa Sargent Conard.

Dr. Herman Persson and his wife have been selected by the University of Washington to collect bryophytes on the coast of British Columbia during part of next summer. It is hoped that many apparent gaps in distribution between Washington and Alaska will be filled in by their work.

Dr. Ruth D. Svihla and her husband, who is a professor of zoology at the University of Washington, are in Mexico for a quarter. While the trip is primarily a vacation, Mrs. Svihla probably will return laden with bryophytes, as she has from their numerous other foreign and domestic trips.

Dr. Mason E. Hale (West Virginia University, Morgantown) has available for limited distribution a multilithed series of lecture notes prepared for a course in lichenology at West Virginia University. It contains chapters on history, morphology, reproduction, chemistry, chemical strains, physiology, distribution and identification, with photographs of about 30 species. Copies may be obtained on request.

Opportunities for Summer Study of Bryology and Other Aspects of Field Botany. The University of Michigan Biological Station again is offering a field course and research facilities in bryology, under the direction of Prof. A. J. Sharp of the University of Tennessee, at its permanent camp on Douglas Lake in northern Michigan. In addition, 16 other courses and research covering most aspects of field and fresh-water biology will be conducted by the faculty of 16 other prominent biologists from six other colleges and universities. Approximately 30 grants-in-aid of $100 to $300 each will be selectively awarded, and 25 self-help jobs will be available. For full information, address Biological Station, University of Michigan, Ann Arbor, Mich.

The American Institute of Biological Sciences and the American Bryological Society. The American Bryological Society is one of 19 societies belonging to AIBS and, although one of the smallest, has equal representation, with one of 19 directors on the governing board. Cost of society membership is figured at $1 per year for each member resident in the U. S. (No payment is made for institutional subscribers or foreign members.) Our society accordingly pays only about $175 annually. Since we have limited funds from dues and spend nearly all our income on *The Bryologist*, some accounting may be appropriate to show that we are getting full value for our money.

Society membership in AIBS means active support for an organization of 17,000 biologists and provides representation on a national level. With headquarters in Wash-

ington, AIBS is in a position to advance the cause of biologists in many ways, in watching legislation, obtaining financial support, stressing importance of biology in the country's welfare and in obtaining draft deferment for biology students. Data on biologists have been compiled for the National Register of Scientific and Technical Personnel. Advisory committees assist the National Science Foundation in administering funds and applications for grants. There is also an advisory committee to the Office of Naval Research, as well as representation on the Scientific Manpower Commission. The central office arranges meetings, symposia and conferences and assists international congresses and delegates. (The editor of *The Bryologist* will participate in a conference of editors of biological journals in 1957.)

AIBS is responsible for scheduling the annual meetings of biological societies on university campuses in the fall rather than at Christmas. The time of year permits forays to be held in conjunction with the meetings. Accommodations in university dormitories and dining halls are less expensive and more convenient than those available in big city hotels. The lower costs more than pay for the dues. Also there are better lecture halls and other facilities.

Each member receives the AIBS *Bulletin*, including the program of annual meetings, and is given reductions in price on symposium volumes and annual subscriptions to *Quarterly Review of Biology*, now an AIBS publication. Other services include a placement service, a group life insurance plan and a visiting lecturers' bureau which provides biology speakers to small colleges.

Because of my location in Washington, I can take up personally with AIBS any matters of interest to the Society that members may suggest. Please note the annual meetings at Stanford in August.—E. L. Little, Jr., Representative on the Governing Board of AIBS.

Duke University has just announced its acquisition of the lichen herbarium of the late Abbé J. Harmand, eminent author of "Lichens de France" and of many other publications. The collections, rich in type or otherwise authentic materials, consist of about 30,000 specimens of which 11,500 are exsiccata. Many of the exsiccata are now in America for the first time. The lichenologists best represented by collections in the herbarium include Anzi, Arnold, Delise, Desmazières, Flagey, E. Fries, Th. Fries, Funck, Harmand, Hepp, Hy, Leighton, Lojka, Malbranche, Mereschowsky, Mudd, Nylander, Olivier, Pitard, Roumeguère, Sandstede, Schaerer, Zahlbruckner and Zwachk The unique collections are primarily European with excellent representations from France, Germany and Russia. Other important materials include those studied by Harmand from New Caledonia, Australia and the Canary Islands. The collections are now being accessioned to Duke Herbarium, already well-known in cryptogamic botany for its possession of the Grout Moss Herbarium, and a more precise designation of the newly received collections will be made following inventory. Arrangements for Duke University's acquisition of the Harmand Herbarium were made through the Stechert-Hafner Co. of New York.

Edwin H. Ketchledge recently completed his Ph.D. dissertation, "A Floristic and Distributional Study of the Mosses of New York State." The degree, from Stanford University, was conferred on January 11 Dr. Ketchledge has prepared a checklist of mosses of New York State; it will be published soon by the N. Y. State Museum. A Ph.D. degree was also conferred, at the same time and by the same institution, on

HARVEY ALFRED MILLER, whose dissertation was entitled "A Phytogeographical Study of Hawaiian Hepaticae." Both Dr. Ketchledge and Dr. Miller were students of William C. Steere.

MISS NIEVA E. VELOIRA, who is working with A. J. Sharp at the University of Tennessee for a period of two years on Philippine bryophytes, is interested in obtaining as much literature as possible to help restock the library at the University of the Philippines. Duplicate reprints and other literature would be greatly appreciated.

MISS YOO HAN LEE from Seoul, Korea, is working with H. A. Miller at Miami University (Oxford, Ohio) on culture studies and sporeling patterns in Hepaticae.

MRS. CLOYD STIFLER (Bradenton, Florida) died suddenly last August. Her daughter wrote, "You may be interested to know that she was working on mosses at the time of her death. They were specimens of M. Diaz-Pifferrer of Cuba, and she was looking forward to a visit from him."

LEO F. KOCH has a grant from the Graduate Research Board of the University of Illinois for field work in California during July and August. He hopes to explore the bryophyte flora of a good part of the area in which groves of the Sierra Redwood, or Big Tree predominate. This will be a continuation of Dr. Koch's investigation of the moss flora of the entire state, as well as a logical complement to his phytogeographic studies on the bryophytes of the Coast Redwood forests.

RUTH S. BREEN has received additional funds from the National Science Foundation for continued work during the next two years on her manual of Florida mosses.

In January WILLIAM MARTIN presented a paper on the distribution of bryophytes in New Zealand to the Congress of the Australian and New Zealand Association for the Advancement of Science at Dunedin On the basis of 12 years' research he was able to show, among other things, that 100 of the New Zealand mosses do not cross the 125 c. m. isohyet, with most mosses being plentiful on one side or the other of that line.

DR. HUGO SJÖRS of the Forestry College, Stockholm, will visit Canada during the summer. He expects to arrive in Ottawa late in May for about three weeks' study at the National Herbarium followed by six weeks of field work on bog ecology in the Hudson Bay Lowlands of northern Ontario. He will be a member of a National Museum Expedition, together with A. E. PORSILD and W. K. W. BALDWIN.

ANNETTA CARTER spent a part of the winter in Central America, and H. A. GLEASON, JR., has been in India and expects to return home about the first of September. HOWARD CRUM and WILFRED SCHOFIELD plan to spend the summer in the Yukon, in the vicinity of Whitehorse. JAMES B. MCFARLIN and Mrs. McFarlin are contemplating a motor trip to Alaska by the Alcan Highway and hope to collect mosses enroute and also in the Canadian Rocky Mt. parks. During the past summer they collected in the U. S. National Parks in the Northwest. DR. HERMAN PERSSON will visit Arizona in April and collect in the Chiricahua Mts. with WILLIAM WEBER and SAM SHUSHAN. WILLIAM C. STEERE plans to visit the Philippine Islands some time during the spring as a member of a review team sent from Stanford University (under contract with the U. S. International Coop-

eration Administration to advise and recommend improvements in the departments of education, engineering and business administration at the University of the Philippines, in connection with the Point 4 Program).

The EDITOR of *The Bryologist* will represent the American Bryological Society at an AIBS-sponsored conference of editors in New Orleans April 2-4.

The annual general meeting and field excursion of the British Bryological Society will be held on Saturday, April 24-29 at Barnstaple, Devon, and vicinity. Excursions by bus are planned for a five-day period, with visits to Braunton Burrows, Clovelly, Hunter's Inn (for Heddon's Mouth and Woody Bay), Combe Martin or the Lee-Morthoe coastal areas and the western edge of Exmoor. The summer meeting will take place in Co. Galway in the Irish Republic from August 17 to 31; headquarters for the first week will be at Salthill, Galway City, and for the second at the Clifden Bay Hotel in Clifden. MR. J. E. PARKER (Dept. of Botany, Queens University, Belfast) will act as Excursion Secretary.

HERBARIA OF HEDWIG AND STEPHANI.—The Hedwig-Schwaegrichen herbarium of mosses and the Stephani herbarium of hepatics both are at Geneva, Switzerland, in the herbarium of the Conservatoire et Jardin Botaniques. Dr. C. E. B. Bonner, who is in charge of the cryptogamic herbarium, showed me these valuable collections during my recent visit there and told me about their history.

The cryptogamic herbarium, which contains several other important collections, is located in another building apart from the main herbarium. Here these collections are readily accessible to bryologists. Incidentally, by special arrangement, portions of type specimens may be lent to monographers who are unable to visit Geneva.

Because moss nomenclature (except Sphagnaceae) begins with Hedwig's *Species Muscorum* (1801), the herbarium of Johann Hedwig (1730-99) and Christian Friederich Schwaegrichen (1775-1853) is of particular importance. Hedwig's posthumous work was edited by Schwaegrichen and completed with later supplements. Moss specimens in the herbarium on that date are types for the names published in 1801. Thus this collection of types is somewhat comparable to the Linnean herbarium for the seed plants and most groups of lower plants. The moss specimens are glued to sheets of white paper smaller than letter size and filed in 12 black cardboard boxes.

Jean-Étienne Duby (1798-1885), a clergyman and amateur bryologist of Geneva, bought the Hedwig-Schwaegrichen herbarium. Dedicated to the study of mosses, he assembled a large collection. Nearly 90 years ago, Duby sold his herbarium to Edmond Pierre Boissier (1810-75) for the large Herbier Boissier, which by will passed to the city of Geneva.

The complete personal herbarium of world hepatics, including drawing and notes, belonging to Franz Stephani (1842-1927) came to the Herbier Boissier by purchase also. In 1898 Stephani signed a contract with William Barbey-Boissier for this life project by which his work on the Hepaticae of the world, *Species Hepaticarum* and a supplement, would be published by that herbarium. As the work progressed, the Herbier Boissier was to receive the specimens of the finished parts and to pay the author in instalments. Containing numerous hepatics submitted from many countries for identification, this collection totaled about 30,000 specimens and 8,000

analytic drawings representing each species. Besides, several thousand duplicates were sold to the herbaria at the British Museum and at Munich.

Afterwards, portions of the collection were lent to Stephani's daughter Johanna, who made copies of the drawings as a means of support for her aged father and herself. Other herbaria also borrowed material to copy drawings. Within the past year some specimens from an old loan were returned from East Germany, where they had been during World War II.—ELBERT L. LITTLE, JR.

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THE HEPATIC EXCHANGE

Beginning January 1, 1939, this Exchange has been operated under the same rules as The Moss Exchange. Privileges are available only to members of the American Bryological Society who have paid annual dues of 25c to Dr. Leo F. Koch, Herbarium, 350 Natural Science Bldg., University of Illinois, Urbana, Ill. Only fully determined specimens in packets with complete data will be accepted. It is suggested that there be at least five packets of each species with an extra which will be forwarded to the Curator of Hepatics for the American Bryological Society Hepatic Herbarium. All material for determination should be sent to the Curator of Hepatics, Dr. Margaret Fulford, Department of Botany, University of Cincinnati, Cincinnati, Ohio.

THE MOSS EXCHANGE

As announced in The Bryologist **38**: 100, Sept.-Oct., 1935, there is now an exchange for mosses. This exchange is available to members of the American Bryological Society upon payment of annual dues of 25c to Dr. E. H. Ketchledge, Dept of Forest Botany, State College of Forestry, Syracuse 10, New York. Only fully identified specimens in packets with complete data on them should be sent in. It is suggested that there be five or more packets of each species.

These two exchanges offer an excellent opportunity for A.B.S. members to build up their own herbaria of choice, well-labelled specimens.